October 30, 1997

EOSDIS Backbone Network (EBnet) Requirements and Implementation Status Review (Revision 1)

October 30, 1997

EBnet
Requirements and Implementation Status Review
(Revision 1)

I. Introduction

Chris Garman

Agenda

I.	Introduction	9:00 - 9:10
II.	Requirements	9:10 - 10:00
	A. Requirements Overview	
	B. Traffic Requirement Changes Review	
	C. Interface Requirements	
III.	EBnet Design	
	A. EBnet WAN Topologies	10:00 - 10:20
	B R E A K	10:20 - 10:40
	B. Site Designs	10:40 - 11:50
	C. Implementation	
	D. Testing	
	E. Network Management System	
IV.	Operations Concept	11:50 - 12:05
V.	Program Topics	12:05 - 12:20
	A. NASA Networking Activities	
	B. Outstanding Issues	
VI.	Conclusion	12:20 - 12:30

Purpose

- Show current understanding of EBnet requirements
- Show current EBnet design
- Show deltas from previous review (May 1996)

Overview of Past EBnet Reviews

- EBnet Status Briefing held in August 1995 provided a high-level overview of the EBnet Project
  - Focused on high-level system requirements, roles, and responsibilities
  - Management and technical approaches to implementation
- EBnet TRMM Review held in November 1995 provided details of the EBnet architecture and planned capabilities, along with the status and schedule of work in progress
- Focused on EBnet readiness to support TRMM
- EBnet AM-1 Review held in May 1996 provided details of the EBnet topology and design, implementation and test plans, and operations concept
- Focused on EBnet readiness to support Landsat-7 and AM-1 testing

Reference Materials

- Requirement Sources
  - EBnet Level 2 Requirements
  - EBnet IRD
  - EBnet ICDs
  - External, as well as internal, traffic requirements are captured in the NISN Traffic Requirements Database (NTRD)
- Documents, NTRD output, and presentation material can be accessed from the EBnet web site at:
  - http://bernoulli.gsfc.nasa.gov/ebnet

II. A. Requirements Overview

Paul Sullivan

Current Status

- The EBnet requirements are documented in the ESDIS Level 2, Volume 6 Document, Number 505-10-01-6
- Document Number 505-10-01-6 History:

Document Issue	Date	CCR Number	CCR Title
Baseline	12/13/95	CCR 505-01-36-001-B	Baseline Volume 6 Document
Change 1	05/02/96	CCR 505-01-30-008-A	Adaptive Downlink Solution
Change 2	05/13/96	CCR 505-01-41-090-C	Deliver Data to a Higher Level Processing
Revision 1	01/10/97	CCR 505-01-36-017	Revise Document Format
Change 1	02/07/97	CCR 505-01-30-011-C	Emergency S-Band Support
Change 2	10/03/97	CCR 505-01-36-018-B	EBnet Level 2 Requirements Updates

Requirement Change Summary

The following major requirement changes have taken place since the 5/96 review:

Description of Change	Volume 6, Level 2 Requirements Affected*	Rationale	Impact
Deleted Comm. Requirements for ECS Project Reference	Revised Requirement Numbers: 262070-Deleted reference 263050-Deleted reference	Document is obsolete	No impact
Revised Bit Error Rate (BER) Performance	Revised Requirement Number: 262110- Added IP packet drop requirement Added New Requirement: 262210: Added BER requirement for clock and data services	Ensure performance reflects current NASA needs as documented by MODNET/NOLAN operational network	No impact
Consolidated Mission Support Requirements	Revised Requirement Number: 262130: Added support to all mission phases Deleted Requirement Numbers: 262170, 262200, 262230 and 262210	Deleted redundant requirements	No impact

* All changes approved by ESDIS Configuration Control Board

Requirement Change Summary

The following major requirement changes have taken place since the 5/96 review:

Description of Change	Volume 6, Level 2 Requirements Affected*	Rationale	Impact
Added support to Alaska and Norway	Revised Requirement Numbers: 262240 & 262250-Change requirement for use of non-terrestrial transport media 263030 & 264030-Change contingency mode site locations Added New Requirement Numbers: 262251 & 262252-Operational availability and MTTRS for Alaska and Norway	Address latest change in contingency mode support	Design, implementation and maintenance of two new sites
Finalize delay contribution	Revised Requirement Number: 263060-Provided 0.75 second contribution	Reflect ESDIS Analysis	No Impact
Finalize EDOS data transfer	Revised Requirement Number: 263080-Revised Mbps rate to 31	Reflect updated EDOS user need	No Impact
Added EDF	New Requirement Number: Added 264160-New EDF site	Address new ECS user requirement	Designed/implemented site at Landover, MD

* All changes approved by ESDIS Configuration Control Board

II.B. Traffic Requirement Changes Review

Ryan Collins

Traffic Requirements Overview

- EBnet Traffic Requirements Reviews
- Configuration Management Methodology
- Information Sources
- Traffic Requirement Changes Since May 1996
- Requirements Timeline
- Summary

EBnet Traffic Requirements Reviews

- Regular traffic requirement reviews conducted since May 1996
- Most recent review held on October 9, 1997
  - Audience was composed of ESDIS / DSNO and ECS representatives
  - Review found no significant discrepancies
  - 13 action items were taken; status is available on the EBnet web site

Configuration Management Methodology

- All EBnet traffic requirements are maintained in the NTRD.
- The contents of the NTRD are used to develop WAN topologies and site designs for EBnet.
- The contents of the NTRD are under configuration control by Nascom/NISN. This is done through the use of Nascom Traffic Requirement (NTR) Configuration Change Request (CCR) forms.
- The EBnet Project team is responsible for identifying requirement changes and submitting a CCR form to the EBnet Systems Engineer for review and approval. The changes in the CCR are then implemented in a "working" version of the NTRD.
- Changes are reviewed by ESDIS and, upon approval, will become part of the "official" EBnet baseline.

Information Sources

Project	Information Source Name
ADEOS-I	ADEOS-I MRR Update Memo
ADEOS-II	ADEOS II Network Flows Spreadsheet
AM-1	ASTER GDS Interface Meeting 10/96
AM-1	EOS SDPRB / SPSO
AM-1	ICD: EBnet-EOC; 540-031
AM-1	ICD: EBnet-SCS; 540-091
AM-1	ICD: EBnet-SSIM; 540-092
AM-1	Volume 0 Appendix D
AM-2	Volume 0 Appendix D
CHEM-1	Volume 0 Appendix D
ECS	ECS SMC Traffic
ECS	ECS User Characterization Group
ECS	ICD: ECS-NOAA ADC; 209-CD-006-004
ESDIS-Institutional Services	EDOS-EBnet ICD
ESDIS-Institutional Services	ICD: EBnet-EOC; 540-031
LALT-1	Volume 0 Appendix D
LANDSAT-7	EOSDIS-Landsat-7 IRD
METEOR	SAGE 3/METEOR Mission Network Plans
PM-1	EOS SDPRB / SPSO
PM-1	Volume 0 Appendix D
PM-2	Volume 0 Appendix D
RADARSAT	ASF/CSA Network Interface Email 7/22/96
TRMM	ICD: V1 LARC and GSFC DAACs
TRMM	ICD: EBnet-TSDIS; 540-047
TRMM	SDPF-TRMM Consumer ICD
TRMM	TRMM-EOSDIS IRD

Traffic Requirement Changes Since May 1996

General Changes:

- CCR #1 – EBnet May 1996 Review Baseline. Major characteristics of this requirement set included the EDOS Reshape (adaptive downlink architecture) and the deletion of the MSFC DAAC.
  - *CCR Implemented in NTRD: 5/8/96*
  - *CCR Approval by ESDIS: 5/9/96*
- CCR #15 – Change in EBnet Protocol Overhead Factor. This CCR modified from 1.333 to 1.25 the overhead factor used to model protocols in OSI layers 1 through 4 supported by EBnet.
  - *CCR Implemented in NTRD: 1/22/97*
  - *CCR Approval by ESDIS: 10/9/97*

Traffic Requirement Changes Since May 1996 (cont'd)

AM-1 ASTER:

- CCR #11 - Addition of AM-1 ASTER Requirements. This CCR added new ASTER traffic requirements between ASTER GDS, GSFC, and JPL. These requirements included Expedited Data Sets (EDS), Housekeeping (real-time and rate-buffered), Human Computer Interface (HCI), Instrument Support Toolkit (IST), and others (e.g., EOC Database transfer and command groups).
  - *CCR Implemented in NTRD: 1/7/97*
  - *CCR Approval by ESDIS: 1/14/97*

Traffic Requirement Changes Since May 1996 (cont'd)

TRMM:

- CCR #6 - Addition of SDPF-TRMM Consumer ICD. This CCR added Quick Look, Level 0, and Ephemeris traffic to the database. These requirements replaced older estimates from the TRMM DMR. It should be noted that the Quick Look delivery times were: 90 minutes assumed domestically; 105 minutes assumed for Japan.
  - *CCR Implemented in NTRD: 8/30/96*
  - *CCR Approval by ESDIS: 1/14/97*
- CCR #10 - Updates from ECS-TRMM IRD DCN-06. This CCR modified terminology in the Comments field as well as the deletion of two records to reflect the changes made in the ECS-TRMM IRD (CCR 505-41-14-006-A, dated 8/96). Note that some Ancillary Data flows remain undefined.
  - *CCR Implemented in NTRD: 1/7/97*
  - *CCR Approval by ESDIS: 1/14/97*

Traffic Requirement Changes Since May 1996 (cont'd)

TRMM (cont'd):

- CCR #16 – Update of EOSDIS-TRMM IRD. This CCR modified existing TRMM traffic requirements to reflect the changes in the IRD's revision (DCN 008-A). Highlights include the change from the ECS DAACs at GSFC and LaRC to the TRMM Support System (TSS) and LaRC TRMM Information System (LaTIS).
  - *CCR Implemented in NTRD: 4/14/97*
  - *CCR Approval by ESDIS: 10/9/97*
- CCR #17 – V1 LARC-GSFC DAAC ICD. This CCR added TRMM traffic as specified in the ICD. A 2/7/97 version of the ICD was initially used; it was formally published as document #423-42-02, titled ICD between the GSFC DAAC TSS and LaRC DAAC LaTIS, and dated 9/97.
  - *CCR Implemented in NTRD: 4/14/97*
  - *CCR Approval by ESDIS: 10/9/97*

Traffic Requirement Changes Since May 1996 (cont'd)

ADEOS-II:

- CCR #14 – ADEOS-II Requirements. This CCR added traffic requirements for the ADEOS-II mission. The source of these requirements was a draft spreadsheet maintained by A. Germain / Swales.
  - *CCR Implemented in NTRD: 1/21/97*
  - *CCR Approval by ESDIS: 10/9/97*
- CCR #18 – ADEOS-II Update. This CCR added traffic requirements for the ADEOS-II mission. The source of these requirements is a spreadsheet maintained by M. Schwaller / 505. This spreadsheet was received on 9/8/97 and included changes through NASDA OCL 26. The effect of this CCR is to replace data originally added with CCR 14.
  - *CCR Implemented in NTRD: 9/24/97*
  - *CCR Approval by ESDIS: 10/9/97*

Traffic Requirement Changes Since May 1996 (cont'd)

ECS:

- CCR #2 - AHWGP Reprocessing Traffic. This change increased inter-DAAC science traffic in 1999 and beyond; only minor changes occurred prior to 1999.
  - *CCR Implemented in NTRD: 6/12/96*
  - *CCR Approval by ESDIS: 7/23/96*
- CCR #9 - ASF Activation Date 12/1/98. This reflected a slip in ASF DAAC activation from 5/1/97 to 12/1/98. Only User Query/Query Response flows were affected by this modification.
  - *CCR Implemented in NTRD: 1/7/97*
  - *CCR Approval by ESDIS: 1/14/97*
- CCR #19 – SMC Traffic. This CCR added SMC traffic to and from the ECS DAACs. The requirements are taken from a write-up by George Mellis of ECS/HITS prepared on 6/10/97.
  - *CCR Implemented in NTRD: 9/24/97*
  - *CCR Approval by ESDIS: 10/9/97*

Traffic Requirement Changes Since May 1996

ECS (cont'd):

- CCR #20 – ECS User Query / Query Response Traffic. This CCR updated ECS User Query / Query Response traffic which was originally in the database from DID-220 and modified manually by EBnet personnel to reflect the closure of the MSFC DAAC. This new data was compiled by the ECS/HITS User Characterization Group and received in 2/97 and prepared by HITS in 4/96.
  - *CCR Implemented in NTRD: 9/29/97*
  - *CCR Approval by ESDIS: 10/9/97*
- CCR #28 – Update of ECS Inter-DAAC Traffic. This CCR updated the inter-DAAC production, archival, and reprocessing traffic between ECS DAACs for AM-1 and PM-1 through 2002. Note that it also included a 433 GB/day flow between GSFC and EDC. Additionally, it accounted for the ramp-up scenario to be used by ECS. The source of the data was the 'DAAC to DAAC Data Traffic' spreadsheet received from Dr. Yun-Chi Lu / 505. The spreadsheets were last updated 10/6/97. It is anticipated that this will be formally distributed by the Science Data Processing Review Board (SDPRB).
  - *CCR Implemented in NTRD: 10/8/97*
  - *CCR Approval by ESDIS: 10/9/97*

Traffic Requirement Changes Since May 1996

EDOS & Ground Station Related:

- CCR #3 - ESDIS Level 2 Requirements, Volume 0, Appendix D Cleanup (ESDIS CCR 505-01-30-009). This change modified store and forward flows for missions beyond AM-1 and corrected errors in PM-1 and PM-2 requirements. Minor data rate corrections were also made for AM-1.
  - *CCR Implemented in NTRD: 6/18/96*
  - *CCR Approval by ESDIS: 7/23/96*
- CCR #4 - Update to EDOS Overhead Factors. Changes affected level 0, expedited, and rate-buffered traffic. A multiplier of 1.25 was adopted for protocol and a multiplier of 1.50 was adopted for contingency. Multipliers for AM-1 expedited traffic were adopted based on AM-1 instrument rates and LZPF processing rates and resulting time to deliver. A generic multiplier was assumed for expedited traffic for all missions beyond AM-1.
  - *CCR Implemented in NTRD: 8/8/96*
  - *CCR Approval by ESDIS: 1/14/97*

Traffic Requirement Changes Since May 1996 (cont'd)

EDOS & Ground Station Related (cont'd):

- CCR #5 - Addition of Reed-Solomon Overhead Factor. This CCR added an overhead factor of 1.16 to account for the Reed Solomon encoding of the clock and data streams that will be stored/forwarded from the GSIFs to the LZPF. This change is to account for the deletion of the Reed-Solomon overhead in the latest update of Appendix D.
  - *CCR Implemented in NTRD: 8/8/96*
  - *CCR Approval by ESDIS: 1/14/97*
- CCR #8 – Re-labeling of Appendix D, Level 0 & Expedited Traffic. Volume 0, Appendix D Level 0, and Expedited instrument traffic were prefaced with "Level 0:" for sort order in the database listing. This action was not content related.
  - *CCR Implemented in NTRD: 1/7/97*
  - *CCR Approval by ESDIS: 1/14/97*

Traffic Requirement Changes Since May 1996 (cont'd)

EDOS & Ground Station Related (cont'd):

- CCR #22 – Change in EOS Contingency Stations. This CCR deleted use of the DSN and GN as contingency ground stations and replaced them with stations in Alaska and Svalbard, Norway (AGS and SGS). It was based on an update to Appendix D of Volume 0 (CCR titled Emergency S-band support for EOS AM-1, initiated on 11/12/96). The start date for this requirement was changed to 11/1/97 for AM-1. Note that this support will be fulfilled by institutional Nascom dedicated data services as opposed to EBnet.
  - *CCR Implemented in NTRD: 10/8/97*
  - *CCR Approval by ESDIS: 10/9/97*
- CCR #29 – Revision of EDOS Operations Management Traffic. This CCR replaced old Table 4 requirements for EDOS operations management traffic with requirements found in the EDOS-EBnet ICD (7/29/96, CDRL B303, 510-ICD-EDOS/EBnet).
  - *CCR Implemented in NTRD: 10/7/97*
  - *CCR Approval by ESDIS: 10/9/97*

Traffic Requirement Changes Since May 1996 (cont'd)

Other Missions:

- CCR #7 - Removal of Landsat-7 Image Assessment System (IAS) flows. A determination was made that these intra-EDC flows would not be supported by EBnet. Comments for this CCR were received at the July 1996 Traffic Review.
  - *CCR Implemented in NTRD: 10/22/96*
  - *CCR Approval by ESDIS: 1/14/97*
- CCR #12 - Addition of ASF-CSA Requirement for RADARSAT. This CCR added a new requirement for RADARSAT from ASF to the Canadian Space Agency (CSA).
  - *CCR Implemented in NTRD: 1/8/97*
  - *CCR Approval by ESDIS: 1/14/97*
- CCR #13 - SAGE III/METEOR Requirements. This CCR added science traffic leaving WFF destined for the LARC DAAC.
  - *CCR Implemented in NTRD: 1/21/97*
  - *CCR Approval by ESDIS: 10/9/97*

Requirements Timeline

Date	Milestone
11/1997	Current configuration and TRMM launch
1/1998	SAS on-line at GSFC
2/1998	SMC active with LaRC, EDC, and NSIDC DAACs
4/1998	AM-1 relocates from VFPA to VAFB
5/1998	Landsat-7 launch
6/1998	AM-1 launch
8/1998	Meteor/SAGE III launch; VAFB support ends
9/1998	SMC active with JPL DAAC
10/1998	Relocate AM-1 SDF from VFPA to GSFC
1/1999	Increase in science volume; ADEOS-II support starts; ASF DAAC active
1/2000	Increase in science volume
6/2000	Initial Alaska and Norway testing
TBD	PM-1 Pre-Launch
12/2000	PM-1 Launch
1/2001	Increase in science volume
1/2002	Increase in science volume

Summary

- EBnet Project has a solid grasp of EOSDIS traffic requirements.
- EBnet Project is working the following traffic requirement issues:
  - Potential transfer of responsibility for AGS and WOTS connectivity for AM-1 contingency support from Nascom to EBnet.
  - PM-1 pre-launch requirements.
  - Operations management data flow between EOC and EOSDIS Ground Terminals.
- EBnet will adopt new and improved requirement sources as they become available.
- Traffic requirements are available on the EBnet web site:
  - http://bernoulli.gsfc.nasa.gov/ebnet

II.C. Interface Requirements

Chris Garman

Overview

- Present all interfaces that EBnet supports.
- Style of section:
  - Show previous configuration presented in May 1996 AM-1 Design Review Package.
  - Show current configuration and planned updates.

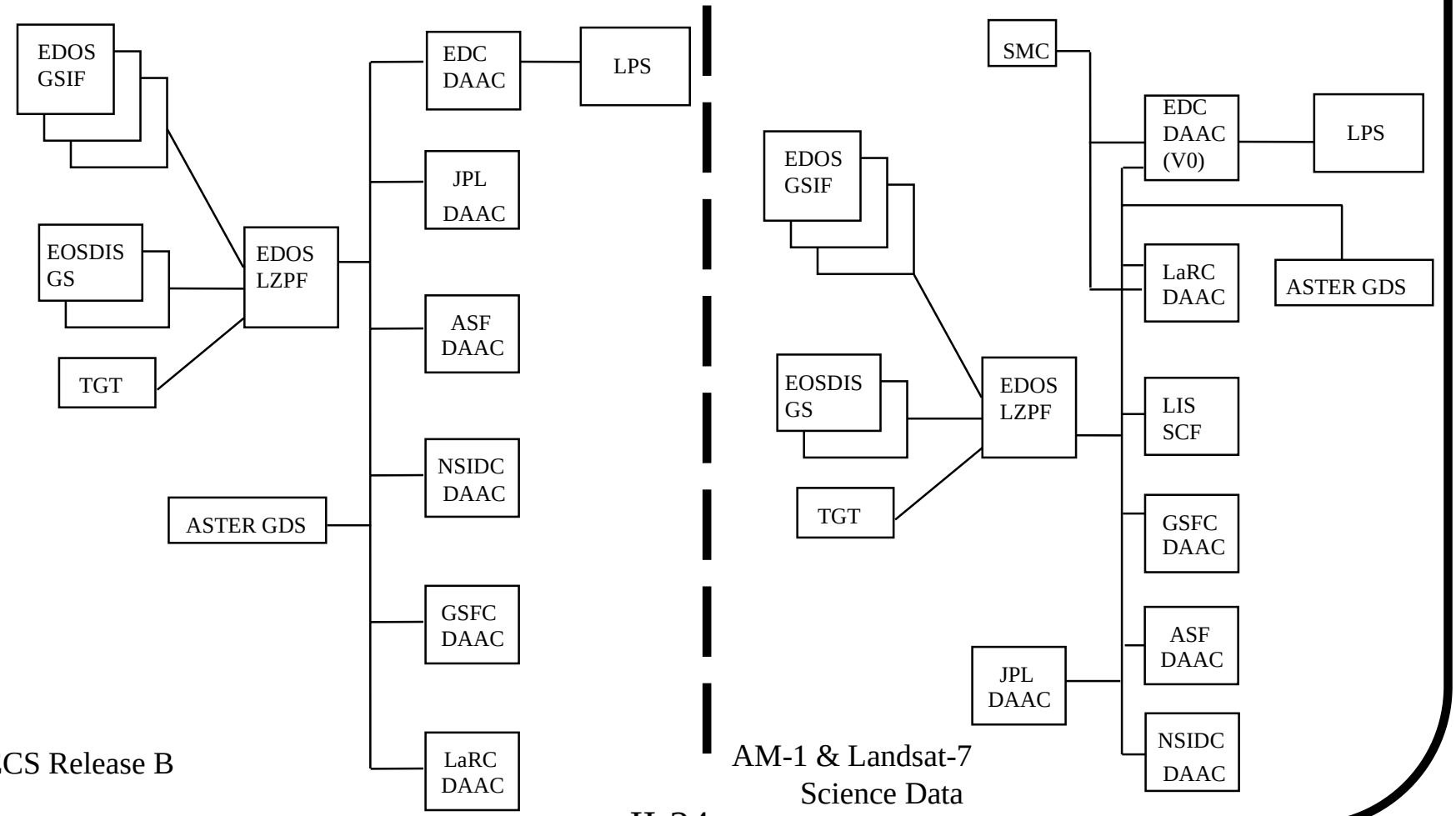
Contents

- System Acronym List
- 5/96 ECS Release B and AM-1 & Landsat-7 Science Data Interfaces
- 10/97 Science Data (ECS) Support
- 10/97 Science Data (ECS) Interface Description Tables
- 5/96 Science Data (TRMM Operations) & ECS Release A Interfaces
- 10/97 Science Data (TRMM Operations)
- 10/97 Science Data (TRMM Operations) Interface Description Tables
- Real-time Ops (AM-1 Testing & Ops)
- 10/97 Real-time AM-1 Ops Interface Description Tables
- ADEOS I & II, RADARSAT, & METEOR Science Data Support
- ADEOS I & II, RADARSAT, & METEOR Science Data Support Interface Description Tables
- 10/97 Space/Ground Prime Support
- 10/97 Space/Ground Prime Support Interface Description Tables
- 5/96 EOC Phases I & II Support
- 10/97 EOC Support
- 10/97 EOC Support Interface Description Tables

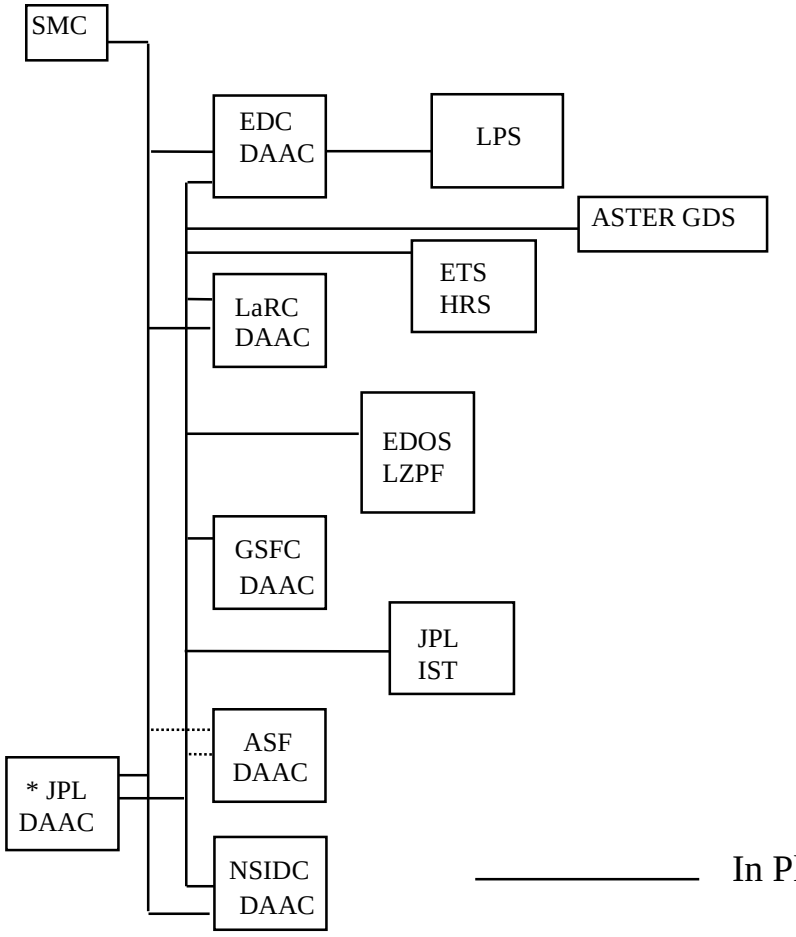
System Acronym List

- ASF - Alaska Synthetic Aperture Radar (SAR) Facility
- ASTER GDS - Advanced Spaceborne Thermal Emission Radiometer Ground Data System (ERSDAC)
- c/d - Clock and Data
- CSA - Canadian Space Agency
- DAAC - Distributed Active Archive Center (ECS)
- ECS - EOSDIS Core System
- EDC - Earth Resources Observation Station (EROS) Data Center
- EDOS GSIF - EOS Data and Operations System Ground Station Interface (EDOS)
- EDOS LZPF - EOS Data and Operations System Level Zero Processing Facility (EDOS)
- EOC - EOS Operations Center (ECS)
- EOP (V2) - EDOS Operational Prototype (Version 2) (TRW - EDOS)
- ERSDAC - Earth Resources Satellite Data Analysis Center
- ETS HRS - EOSDIS Test System High Rate System
- ETS LRS - EOSDIS Test System Low Rate System
- ETS MPS - EOSDIS Test System Multimode Portable Simulator
- FDD - Flight Dynamics Division
- FDF - Flight Dynamics Facility
- FSTB - Flight Software Testbed
- GSE - Ground Support Equipment
- GSFC - Goddard Space Flight Center
- JPL - Jet Propulsion Laboratory
- IST - Instrument Support Terminal (ECS)
- LaRC - Langley Research Center
- LaTIS - LaRC TRMM Information System
- LIS SCF - Lightning Imaging Sensor Science Computing Facility (MSFC)
- LPS - Landsat Processing System
- MOC - Mission Operations Center
- NASDA EOC - National Space Development Agency (of Japan) Earth Observation Center (NASDA)
- NCC - Network Control Center
- NESDIS - National Environmental Satellite, Data and Information Service (NOAA)
- NSIDC - National Snow and Ice Data Center
- RB - Rate Buffered
- RT - Real Time
- SAS - Spacecraft Analysis System
- SCS - Spacecraft Checkout Station
- SMC - Systems Monitoring and Coordination Center (ECS)
- SDF - Software Development Facility
- SDPF - Science Data Processing Facility
- SSIM - Spacecraft Simulator
- TRMM - Tropical Rainforest Measuring Mission
- TSS - TRMM Support System
- TGT - TDRSS Ground Terminal
- TSDIS - TRMM Science Data and Information System
- VAFB - Vandenburg Air Force Base
- WSC - White Sands Complex
- WFF - Wallops Flight Facility

5/96 ECS Release B and AM-1 & Landsat-7 Science Data Interfaces



10/97 Science Data (ECS) Support



* EBnet hardware in place; JPL DAAC hardware to be installed mid 1998

10/97 Science Data (ECS) Interface Description (1/4)

System	Location	Need date	Data Rate
ASF DAAC	ASF	~~5/97~~ 1/99	to Other DAACs: ~~5~~ 4 Kbps to SMC: 20 Kbps
EDC DAAC	EDC	~~5/97~~ In Place	to GSFC DAAC: ~~779~~ 238 Kbps to Other DAACs: ~~5~~ 3 Kbps to SMC: 286 Kbps
GSFC DAAC	Bldg 32, GSFC	~~5/97~~ In Place	to ASTER GDS: 150 Kbps to EDC DAAC: ~~10~~ 25.2 Mbps to LaRC DAAC: ~~20 Mbps~~ 7 Kbps to JPL DAAC: ~~18~~ 13 Kbps to NSIDC DAAC: ~~154~~ 399 Kbps ~~to ASF DAAC: 1 Kbps~~
JPL DAAC	JPL	~~5/97~~ In Place	to Other DAACs: ~~5~~ 2 Kbps to SMC: 25 Kbps

Note: Inter-DAAC traffic rates constitute first year ramp up flow rates through 12/98

10/97 Science Data (ECS) Interface Description (2/4)

System	Location	Need date	Data Rate
LaRC DAAC	LaRC	~~5/97~~ In Place	~~to EDC DAAC: 565 Kbps~~ to Other DAACs: ~~10~~ 16 Kbps to SMC: 112 Kbps
NSIDC DAAC	NSIDC	~~5/97~~ In Place	to EDC DAAC: ~~268~~ 63Kbps to Other DAACs: 1 Kbps to SMC: 66 Kbps
~~EDOS GSIF~~	~~WSC~~	~~1/97~~	~~to EDOS LZPF: 31 Mbps (science c/d)~~ Shown with Space/Ground Interfaces
EDOS LZPF	Bldg 32, GSFC	~~1/97~~ In Place	~~to EOSDIS GS: 0.125, 1, 2, 10 Kbps (realtime c/d)~~ Shown with Space/Ground Interfaces to GSFC DAAC: ~~13~~ 17.3Mbps to LaRC DAAC: ~~7~~ 9.9 Mbps

10/97 Science Data (ECS) Interface Description (3/4)

System	Location	Need date	Data Rate
ASTER GDS	Tokyo, Japan	~~4/97~~ In Place	to GSFC DAAC~~s~~: ~~TBD~~ 63 Kbps to JPL IST: 369 Kbps
LPS	EDC	~~5/97~~ In Place	to EDC DAAC: ~~85~~ 79.9 Mbps
~~EOSDIS GS~~	~~Spitzbergen, Norway Fairbanks, Alaska~~	~~6/00~~	~~to EDOS LZPF: 1, 16, 512 Kbps (realtime c/d)~~ Shown in Space/Ground Interface Diagram
~~EDOS GSIF~~	~~Spitzbergen, Norway Fairbanks, Alaska~~	~~6/00~~	~~to EDOS LZPF: 31 Kbps (science c/d)~~ Shown in Space/Ground Interface Diagram

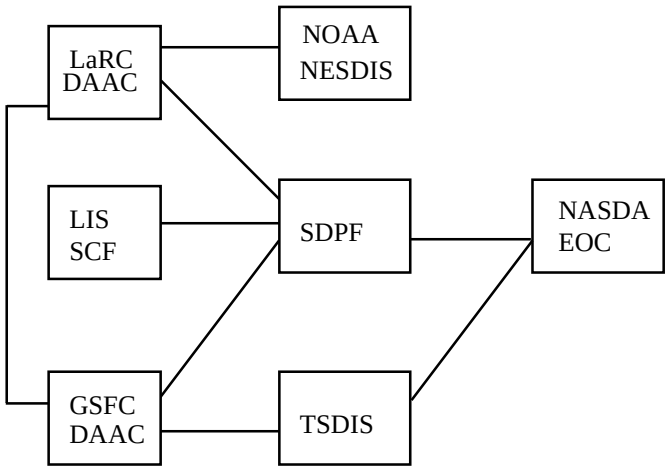
10/97 Science Data (ECS) Interface Description (4/4)

System	Location	Need date	Data Rate
SMC	Bldg 32, GSFC	In Place 1/99	to EDC DAAC: 37 Kbps to LaRC DAAC: 12 Kbps to JPL DAAC: 5 Kbps to NSIDC DAAC: 9 Kbps to ASF DAAC: 5 Kbps
ETS HRS	Bldg 32, GSFC	In Place	* to EDOS LZPF: 34.0 Mbps * to GSFC DAAC: 34.0 Mbps

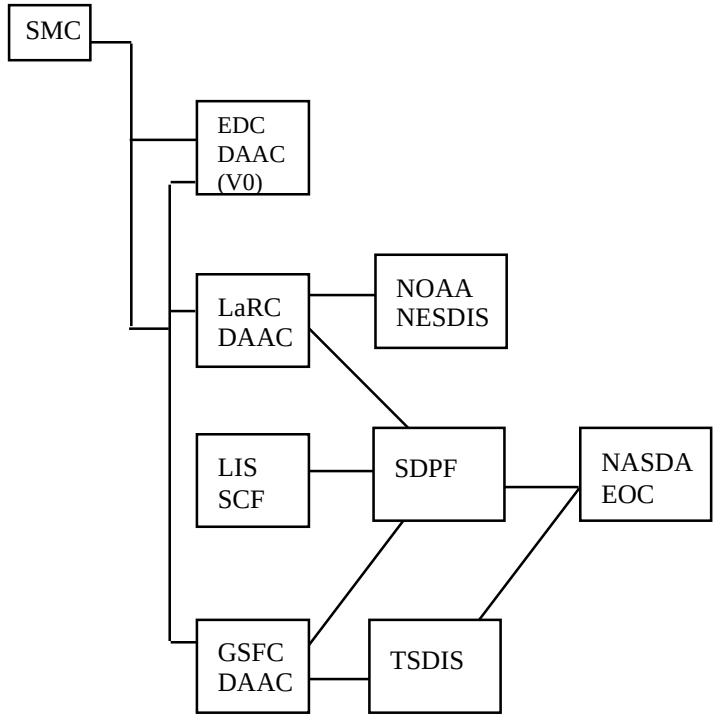
* Currently not in NTRD, must be added

No increase in bandwidth necessary, operates within available bandwidth

5/96 Science Data (TRMM Operations) & ECS Release A Interfaces

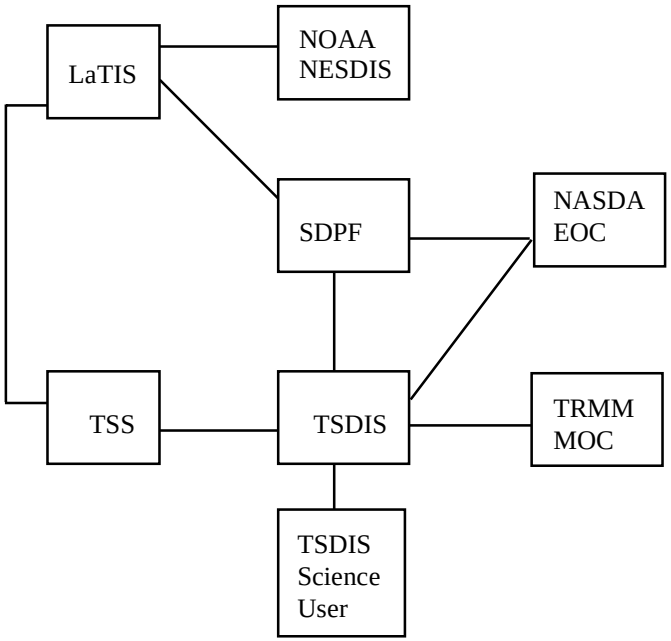


Science Data (TRMM Operations)



ECS Release A Interfaces

10/97 Science Data (TRMM Operations)



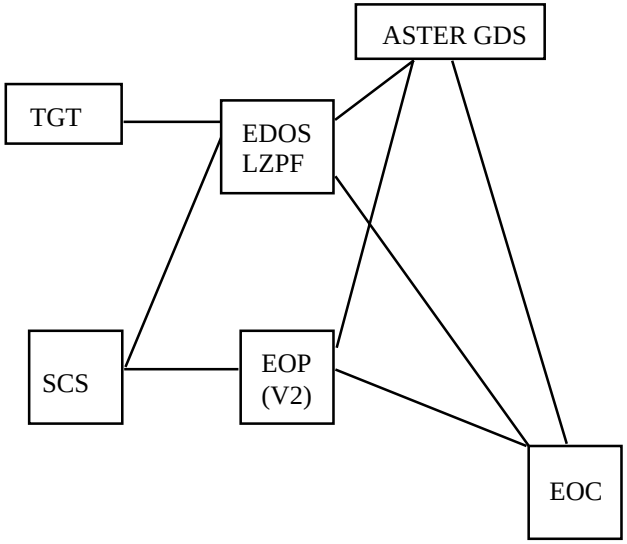
10/97 Science Data (TRMM Operations) Interface Description (1/2)

System	Location	Need date	Data rate
~~DAAC~~ ~~GSFC~~ TSS	Bldg 32, GSFC	~~8/96~~ In Place	to TSDIS: ~~2~~ 9.7 Mbps to ~~LaRC DAAC~~ LaTIS: ~~3~~ 910 Kbps
~~LaRC~~ ~~DAAC~~ LaTIS	LaRC	~~8/96~~ In Place	
~~LIS SCF~~	~~MSFC~~	~~8/96~~	
NASDA EOC	Japan	In Place	to TSDIS: 0.32 Kbps
NOAA NESDIS	Suitland MD	In Place	to LaRC DAAC: ~~495~~ 465 Kbps
SDPF	Bldg 23	In Place	to ~~LaRC DAAC~~ LaTIS: ~~25~~ 122 Kbps to TSDIS: ~~716~~ 743 Kbps ~~to LIS SCF: 55 Kbps~~ to NASDA EOC: ~~359~~ 501Kbps (V0)

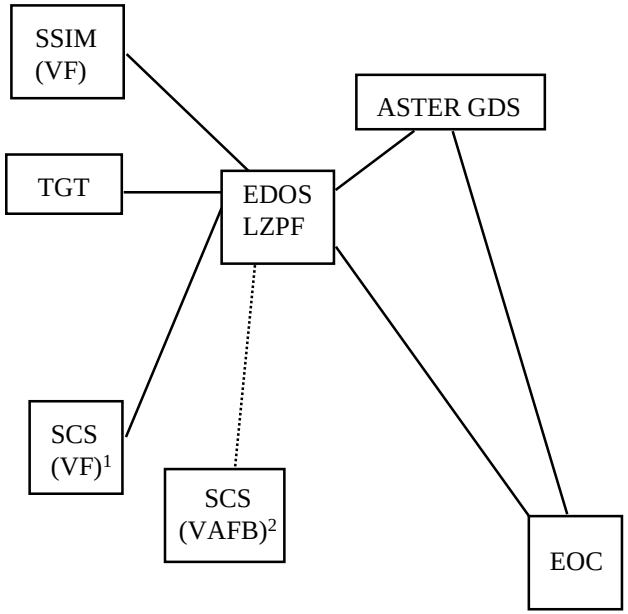
10/97 Science Data (TRMM Operations) Interface Description (2/2)

System	Location	Need date	Data rate
TSDIS	Bldg 32, GSFC	In Place	to ~~GSFC DAAC~~ TSS: ~~18~~ 24.2 Mbps to NASDA EOC: 0.9 Kbps to TSDIS Science User: 664 Kbps to TRMM MOC: 0.3 Kbps to SDPF: Low
TRMM MOC	GSFC	In Place	to TSDIS: 13 Kbps
TSDIS Science User	TSDIS Science User	In Place	to TSDIS: 1 Kbps

Real-time Ops (AM-1 Testing & Ops)



May 1996 AM-1 Review



October 1997 Networks Review

——— In Place

..... To Be Implemented

[1] SCS VF will be supported through spacecraft shipment to VAFB

[2] SCS VAFB will be supported from 4/98 through launch

10/97 Real-time AM-1 Ops Interface Description (1/2)

System	Location	Need date	Data rate
EOC	Bldg 32, GSFC	~~8/96~~ In Place	to EDOS LZPF: 17 Kbps RT (1 min) to EDOS LZPF: ~~119~~ 104 Kbps ~~other~~ RT (4 hr) to ASTER GDS: 64 Kps
SCS	Valley Forge, PA (VAFB)	~~8/96~~ In Place (~~3~~4/98)	to EDOS LZPF~~/EOP (V2~~): 1, 16, or 256 Kbps (c/d)
SSIM	Valley Forge, PA	In Place	to EDOS LZPF): 1, 16, or 256 Kbps (c/d)
~~EOP* (V2)~~	~~Bldg 32~~	~~9/96~~	~~(same as EDOS LZPF)~~
TGT	WSC	~~1/97~~ In Place	to EDOS LZPF: 1, 16, or 256 Kbps (c/d)

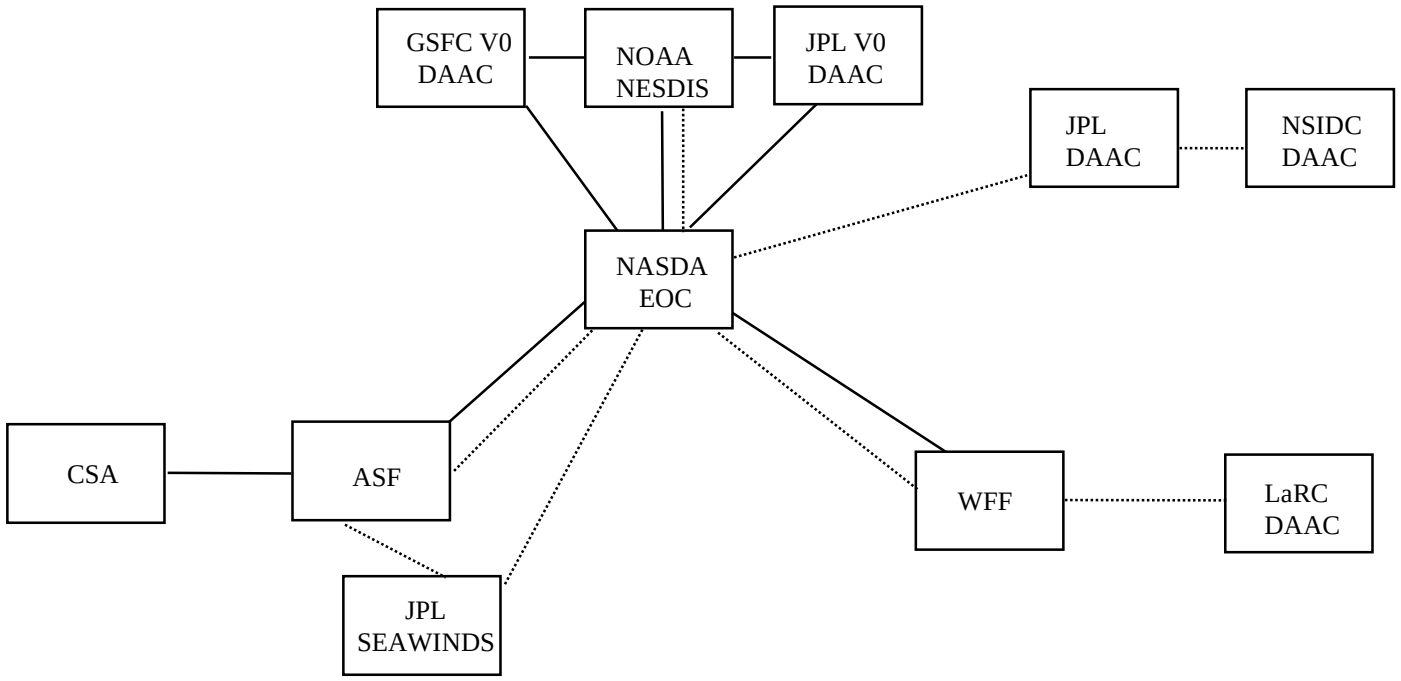
Note: RT = Real Time
c/d = clock and data

10/97 Real-time AM-1 Ops Interface Description (2/2)

System	Location	Need date	Data rate
ASTER GDS	Tokyo, Japan	~~4/97~~ In Place	to EOC: ~~TBD~~ 64 Kbps ~~to DAACs: TBD~~ Shown with ECS Data Support ~~to IST US (JPL): TBD~~ Shown with ECS Data Support
EDOS LZPF	Bldg 32, GSFC	~~1/97~~ In Place 4/98	to EOC: 42 Kbps RT (1 Min) to EOC: 104 Kbps RT (4 Hr) to EOC: ~~1.4~~ 1.8 Mbps RB to ASTER GDS: 42 Kbps RT (1 Min) to ASTER GDS: to ~~42~~ 65 Kbps RB to SCS (VF): 0.125, 1, 2, or 10 Kbps (RT c/d) to TGT: 0.125, 1, 2, or 10 Kbps (RT c/d) to SCS (VAFB: 0.125, 1, 2, or 10 Kbps (RT c/d)

Note: RB = Rate Buffered

ADEOS I & II, RADARSAT, & METEOR
Science Data Support



ADEOS I & II, RADARSAT & METEOR
Science Data Support (1/3)

System	Location/Mission	Need date	Data Rate
ASF	Alaska/ADEOS I	In Place	to NASDA EOC: 0.1 Kbps (V0) to CSA: 2 Kbps
	Alaska/RADARSAT		to NASDA EOC: 924 Kbps
	Alaska/ADEOS II	1/99	to JPL SeaWinds Project: 690 Kbps
NASDA EOC	Hatoyama, Japan / ADEOS I	In Place	to ASF: 7 Kbps (V0) to GSFC V0 DAAC: 37 Kbps (V0) to JPL V0 DAAC 54 Kbps (V0) to NOAA NESDIS: 498 Kbps (V0) to WFF: 6Kbps (V0) to ASF: 0.2 Kbps to JPL DAAC: 625Kbps
	Hatoyama, Japan / ADEOS II	1/99	to JPL SeaWinds Project: 65 Kbps to JPL DAAC (PODAAC): 138 Kbps to NOAA: 701 Kbps to WFF: 0.2 Kbps

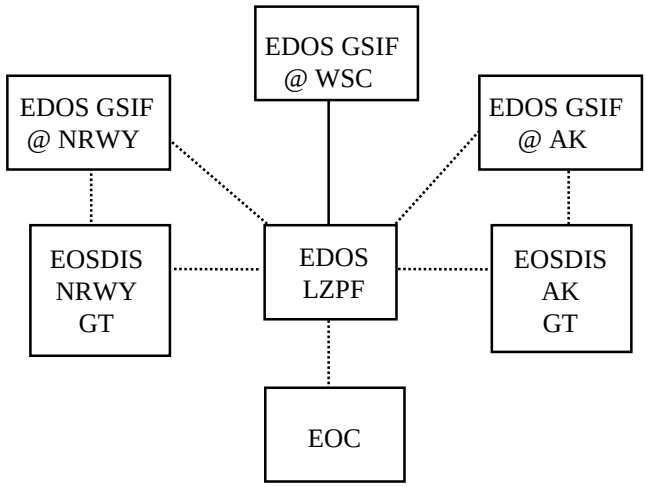
ADEOS I & II, RADARSAT, & METEOR
Science Data Support (2/3)

System	Location/Mission	Need date	Data Rate
GSFC V0 DAAC	GSFC / ADEOS I	In Place	to NASDA EOC: 39 Kbps (V0)
JPL V0 DAAC	JPL / ADEOS I	In Place	to NASDA EOC: 0.05 Kbps (V0)
JPL DAAC	JPL / ADEOS II	1/99	to NSIDC DAAC: 138 Kbps
NOAA NESDIS	Suitland, MD / ADEOS I	In Place	to GSFC V0 DAAC: 31 Kbps V0) to NASDA EOC: 44 Kbps (V0) to JPL V0 DAAC: 14 Kbps (V0)
Canadian Space Agency	Quebec, Canada / RADARSAT	In Place	to ASF: 7 Kbps
LaRC DAAC	LaRC / METEOR	8/98	to WFF: low

ADEOS I & II, RADARSAT, & METEOR
Science Data Support (3/3)

System	Location/Mission	Need date	Data Rate
WFF	WFF / ADEOS I WFF / METEOR WFF / ADEOS II	In Place 8/98 1/99	to NASDA EOC: 0.1 Kbps (V0) to LaRC DAAC: 312 Kbps to NASDA EOC: 924 Kbps to JPL SeaWinds Project: 690 Kbps
JPL Seawinds Project	JPL/ADEOS II	1/99	
NSIDC DAAC	NSIDC	In Place	

10/97 Space/Ground Prime Support



In Place

To Be Implemented

10/97 Space/Ground Prime Support Interface Description (1/2)

System	Location	Need date	Data rate
EDOS GSIF	Alaska	6/00	to EOSDIS Alaska GT: 104 Kbps to EDOS LZPF: 104 Kbps to EDOS LZPF: 35.5 Mbps (c/d)
EDOS LZPF	GSFC	In Place 6/00	to EDOS GSIF @ WSC: 104 Kbps to EDOS GSIF @ Alaska: 104 Kbps to EDOS GSIF @ Norway: 104 Kbps to EOSDIS Alaska GT: 2 Kbps (c/d) to EOSDIS Norway GT: 2 Kbps (c/d) *to EOC: 104 Kbps
EDOS GSIF	Norway	6/00	to EOSDIS Norway GT: 104 Kbps to EDOS LZPF: 104 Kbps to EDOS LZPF: 35.5 Mbps (c/d)

* Currently not in NTRD, must be added

Note: Requirements are for initial support and will increase beginning in 12/00

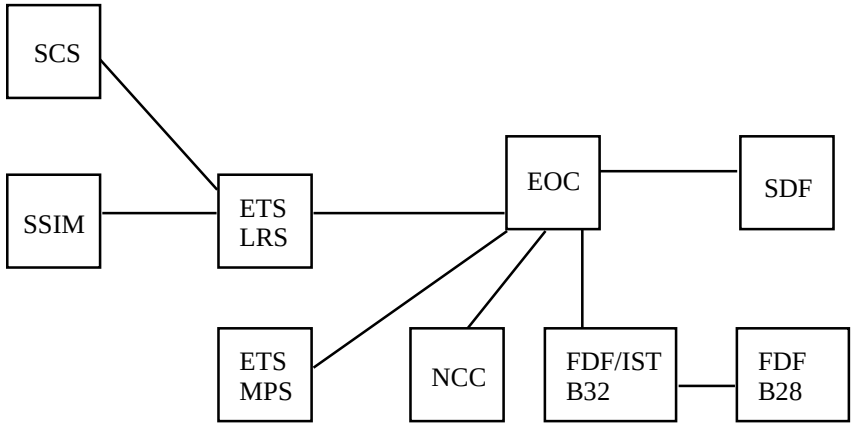
10/97 Space/Ground Prime Support Interface Description(2/2)

System	Location	Need date	Data rate
EOSDIS GT	Alaska	6/00	to EDOS LZPF: 16, 512 Kbps (c/d) *to EDOS GSIF @ Alaska: 104 Kbps
EOSDIS GT	Norway	6/00	to EDOS LZPF: 16, 512 Kbps (c/d) *to EDOS GSIF @ Norway: 104 Kbps
EDOS GSIF	WSC	In Place	to EDOS LZPF: 104 Kbps to EDOS LZPF: 35.5 Mbps SF (c/d)
EOC	GSFC	6/00	*to EDOS LZPF: 104 Kbps

* Currently not in NTRD, must be added

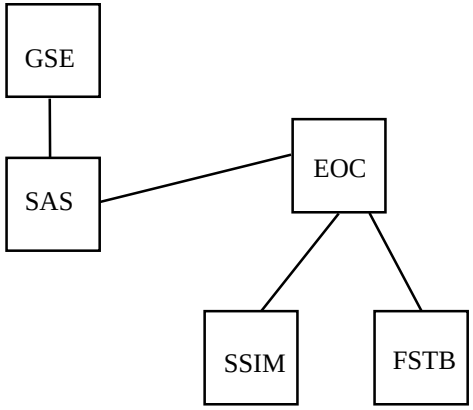
Note: Requirements are for initial support and will increase beginning in 12/00

5/96 EOC Phases I & II Support

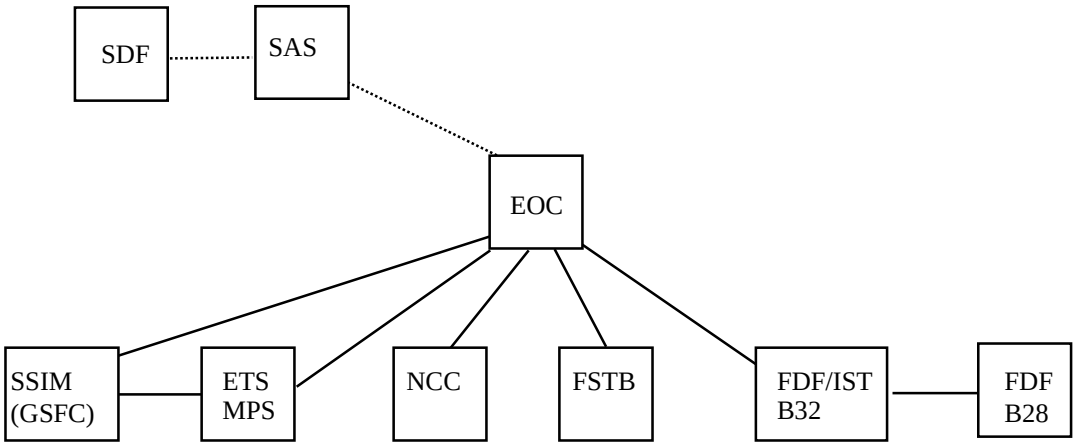


EOC Phase I
Support

EOC Phase II
Support



10/97 EOC Support



Present Through AM-1 Launch and Beyond

To Be Implemented

10/97 EOC Support Interface Description (1/3)

System	Location	Need date	Data Rate
EOC	Bldg 32, GSFC	~~8/96~~ In Place	to FDF/IST: 1.0 Mbps to NCC: 119 Kbps ~~to ETS LRS: (same as EDOS LZPF)~~ to ETS MPS: ~~(same as EDOS LZPF)~~ 131 Kbps
NCC	Bldg 13, GSFC	~~8/96~~ In Place	to EOC: 476 Kbps
SDF	Valley Forge, PA	8/96	to EOC: 512 Kbps
~~ETS HRS~~	~~Bldg 32~~	~~10/96~~	~~to EDOS: 34 Mbps~~ Shown with Science Data (ECS) Support Interfaces ~~to DAAC: 34 Mbps~~ Shown with Science Data (ECS) Support Interfaces

10/97 EOC Support Interface Description (2/3)

System	Location	Need date	Data Rate
~~SCS*~~	~~Valley Forge, PA~~	~~9/96~~	~~to ETS LRS: (same as EDOS LZPF)~~
~~ETS LRS~~	~~Bldg 25~~ ~~Bldg 32~~	~~8/96~~ ~~9/96~~	~~to EOC: (same as EDOS LZPF)~~ ~~to SCS: (same as EDOS LZPF)~~ ~~to SSIM: (same as EDOS LZPF)~~
ETS MPS	~~Bldg 24~~ Bldg 32, GSFC	~~7/96~~ ~~10/96~~ In Place	to EOC: (same as EDOS LZPF) 10 Kbps
~~SSIM*~~	~~Valley Forge, PA~~	~~1/97~~	~~to ETS LRS: (same as EDOS LZPF~~
FDF	Bldg 32, GSFC Bldg 28, GSFC	~~TBD~~ In Place	to EOC: 1.0 Mbps to FDF/IST: 512 Kbps (TBR)

~~*SSIM and SCS are assumed to be mutually exclusive~~

*SCS (VF) now shown with AM-1 Ops Interfaces

10/97 EOC Support Interface Description (3/3)

System	Location	Need date	Data Rate
SSIM	Bldg 32	~~6/97~~ In Place	to EOC: ~~512~~ 1.2 M~~K~~bps
FSTB	Bldg 1	~~12/97~~ In Place	to EOC: ~~56~~ 131 Kbps
SAS	Bldg 32	~~12/97~~1/98 In Place	to EOC: ~~512 Kbps~~ 1.2 Mbps to SDF, GSFC: 1.2 Mbps
~~GSE~~	~~Valley Forge, PA~~	~~launch~~	~~to SAS: 56 Kbps~~

III.A. EBnet WAN Topologies

Steve Booth

Overview

- Topology Timeline
- Topology Scope
- EBnet WAN Topologies (Current - 2002)

Topology Timeline

Date	Milestone	EBnet Topology Change
11/1997	Current configuration and TRMM launch	√
1/1998	SAS on-line at GSFC	
2/1998	SMC active with LaRC, EDC, and NSIDC DAACs	
4/1998	AM-1 relocates from VFPA to VAFB	√
5/1998	Landsat-7 launch	
6/1998	AM-1 launch	
8/1998	Meteor/SAGE III launch; VAFB support ends	√
9/1998	SMC active with JPL DAAC	
10/1998	Relocate AM-1 SDF from VFPA to GSFC	
1/1999	Increase in science volume; ADEOS-II support starts; ASF DAAC active	√
1/2000	Increase in science volume	√
6/2000	Initial Alaska and Norway testing	√
TBD	PM-1 Pre-Launch	#
12/2000	PM-1 Launch	
1/2001	Increase in science volume	√
1/2002	Increase in science volume	√

Topology unavailable; PM-1 Pre-Launch requirements undefined

Topology Scope

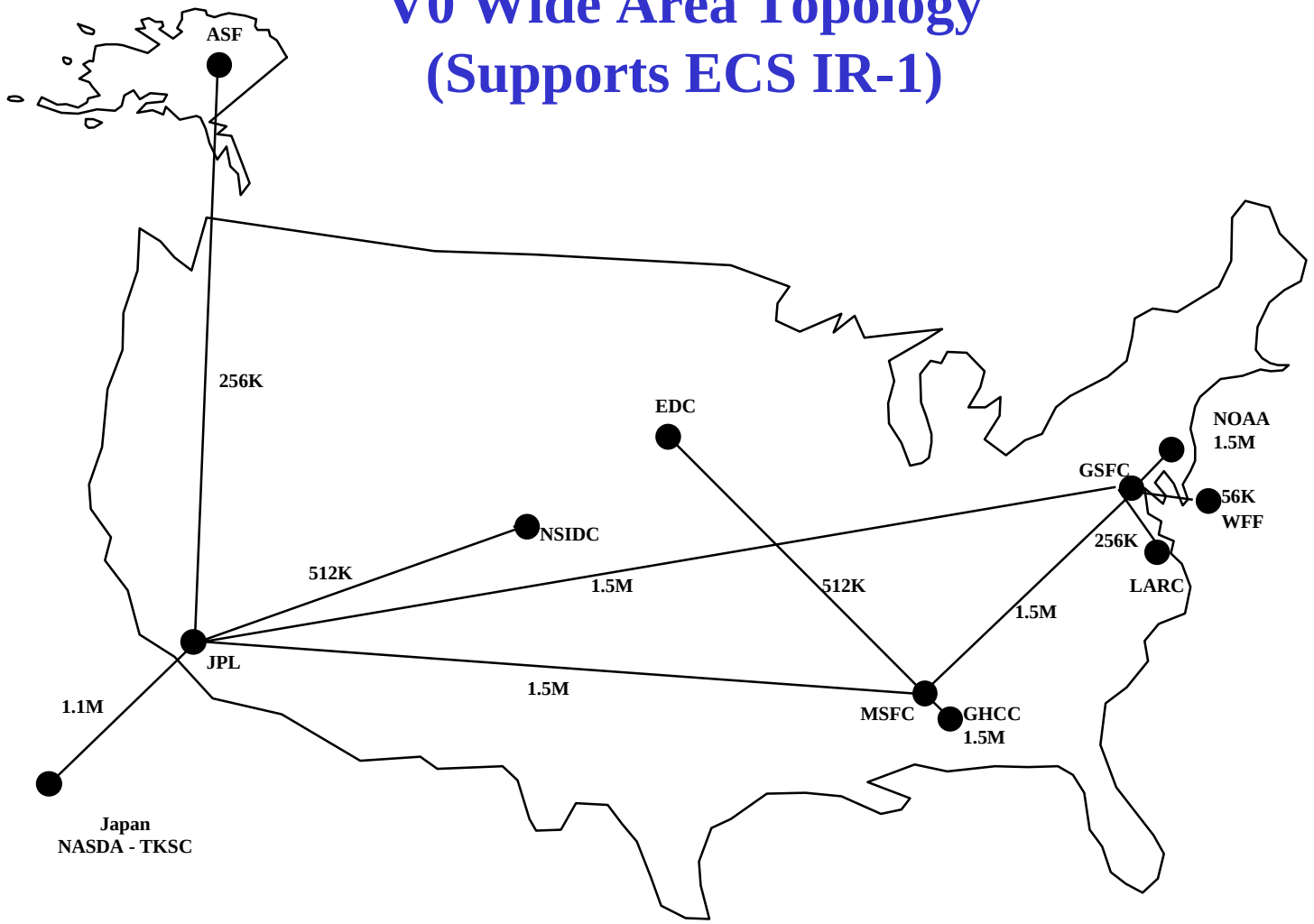
- Mission Critical IP Routed Data Service
  - Locations: GSFC and Japan
  - One-minute MTTRS
  - Redundant equipment and circuits
  - Goal, use ISDN for dial back-up to Japan

- Premium IP Routed Data Service (Science Network)
  - No redundancy
  - Four-hour MTTRS

Topology Scope (cont'd)

- Dedicated Data Service (Clock and Data Network)
  - TDRSS Commands/Housekeeping Telemetry
    - One-minute MTTRS
    - Locations: GSFC and WSC
  - Polar Site Commands/Housekeeping Telemetry
    - Four-hour MTTRS
    - Locations: GSFC, AK, and NRW
  - Science Data
    - Four-hour MTTRS
    - Locations: GSFC, WSC, AK, and NRW
  - Testing
    - Four-hour MTTRS
    - Locations: GSFC, VAFB, and VFPA

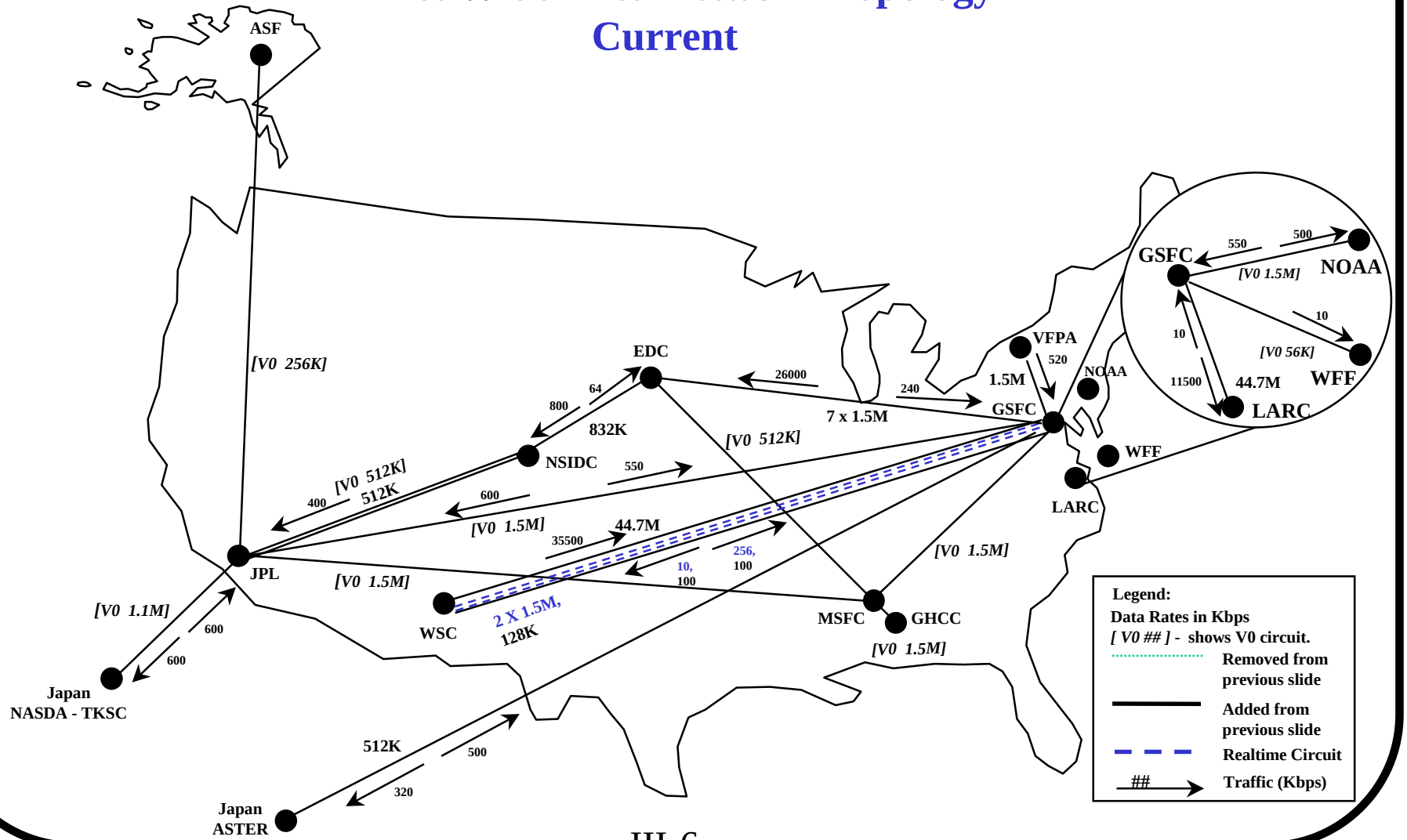
V0 Wide Area Topology (Supports ECS IR-1)



EBnet

Networks Review

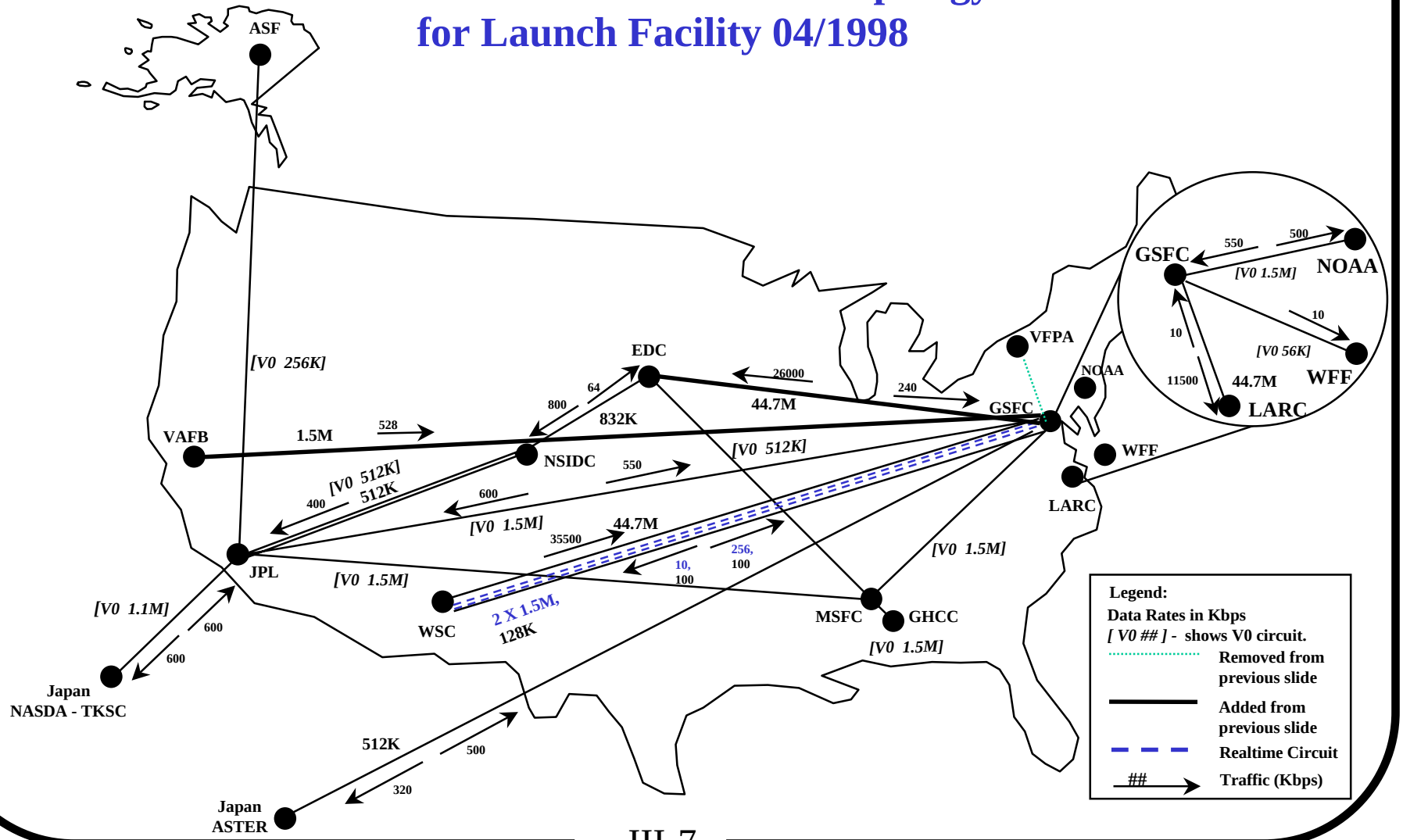
EBnet Wide Area Network Topology
Current



EBnet

Networks Review

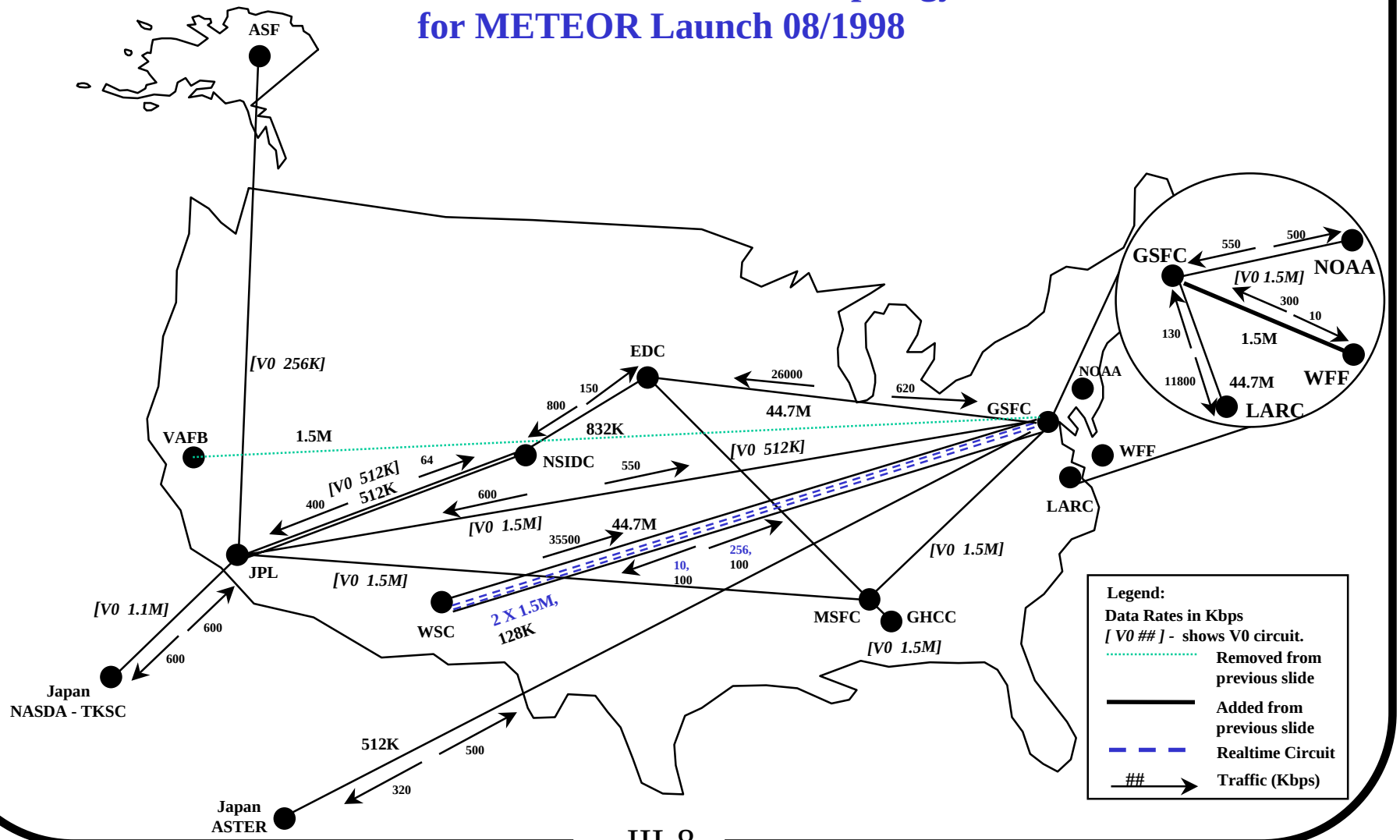
EBnet Wide Area Network Topology for Launch Facility 04/1998



EBnet

Networks Review

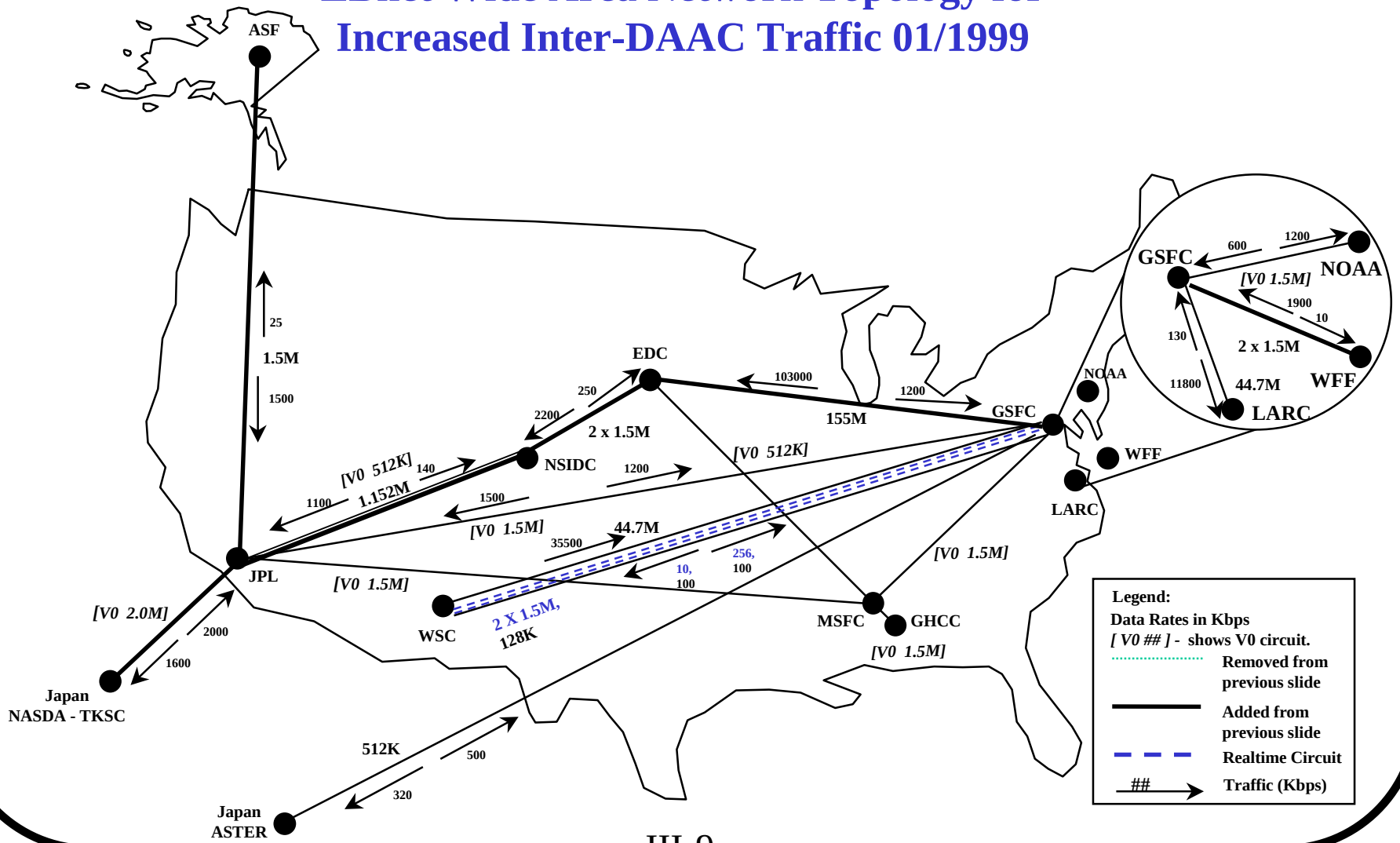
EBnet Wide Area Network Topology for METEOR Launch 08/1998



EBnet

Networks Review

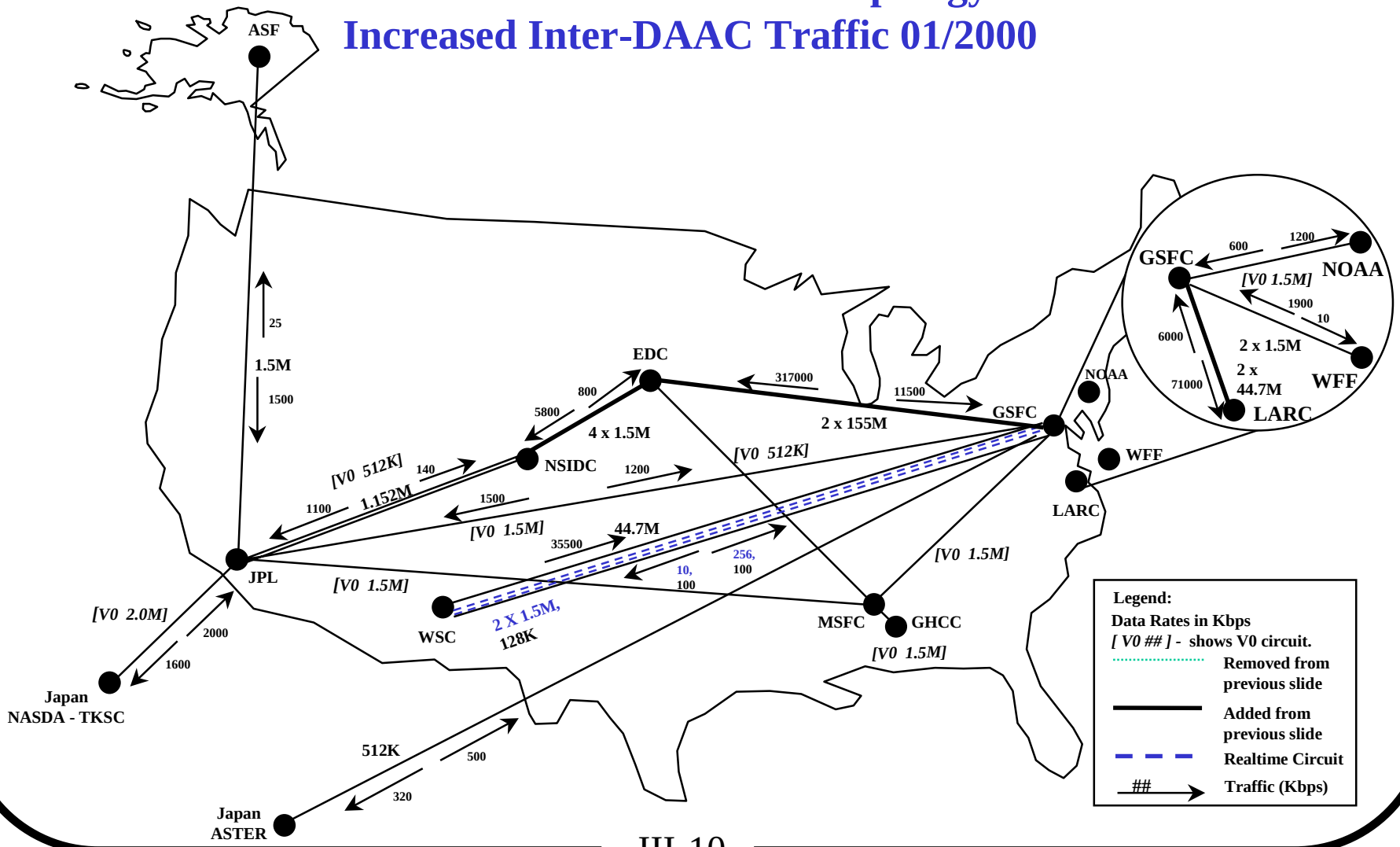
EBnet Wide Area Network Topology for Increased Inter-DAAC Traffic 01/1999



EBnet

Networks Review

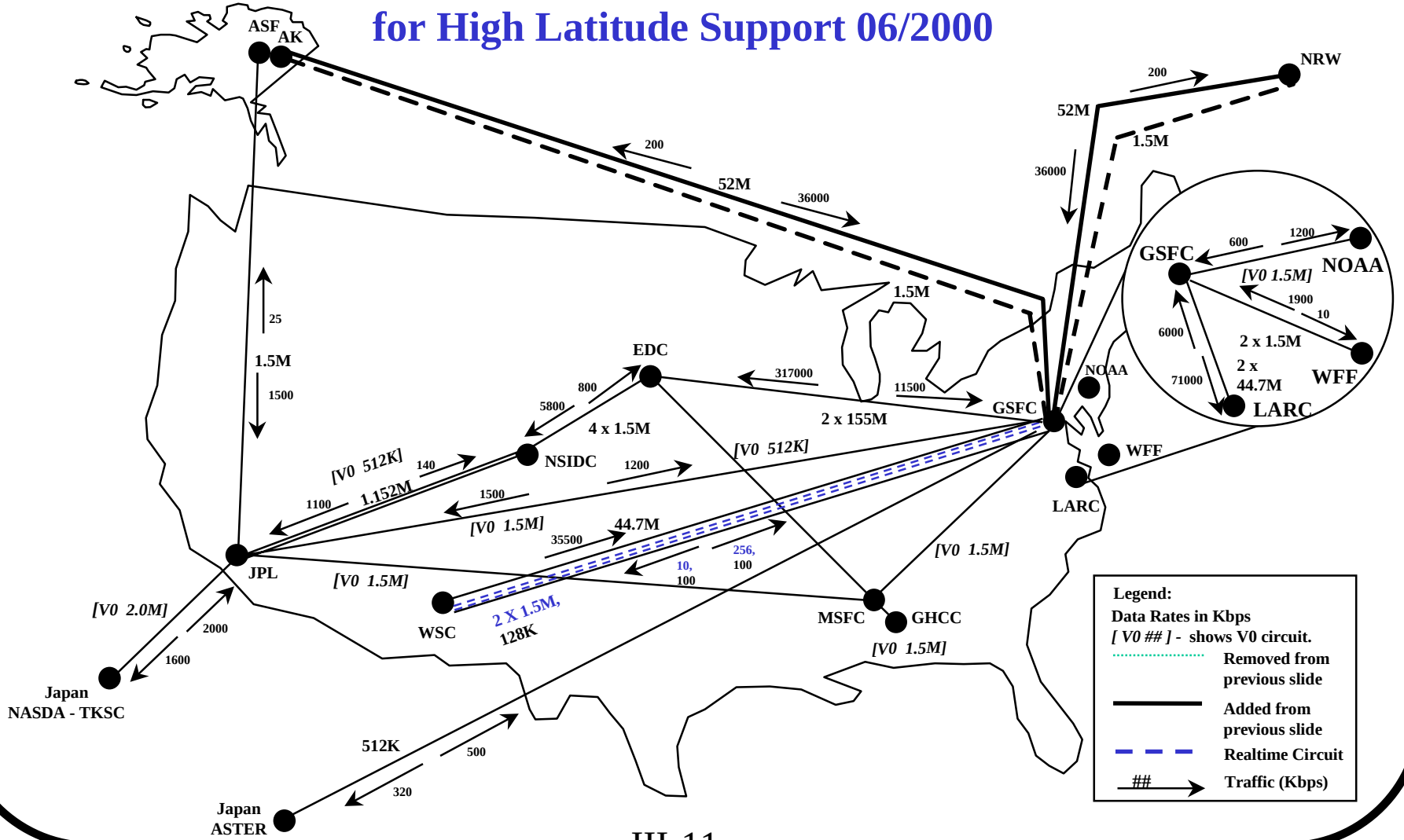
EBnet Wide Area Network Topology for Increased Inter-DAAC Traffic 01/2000



EBnet

Networks Review

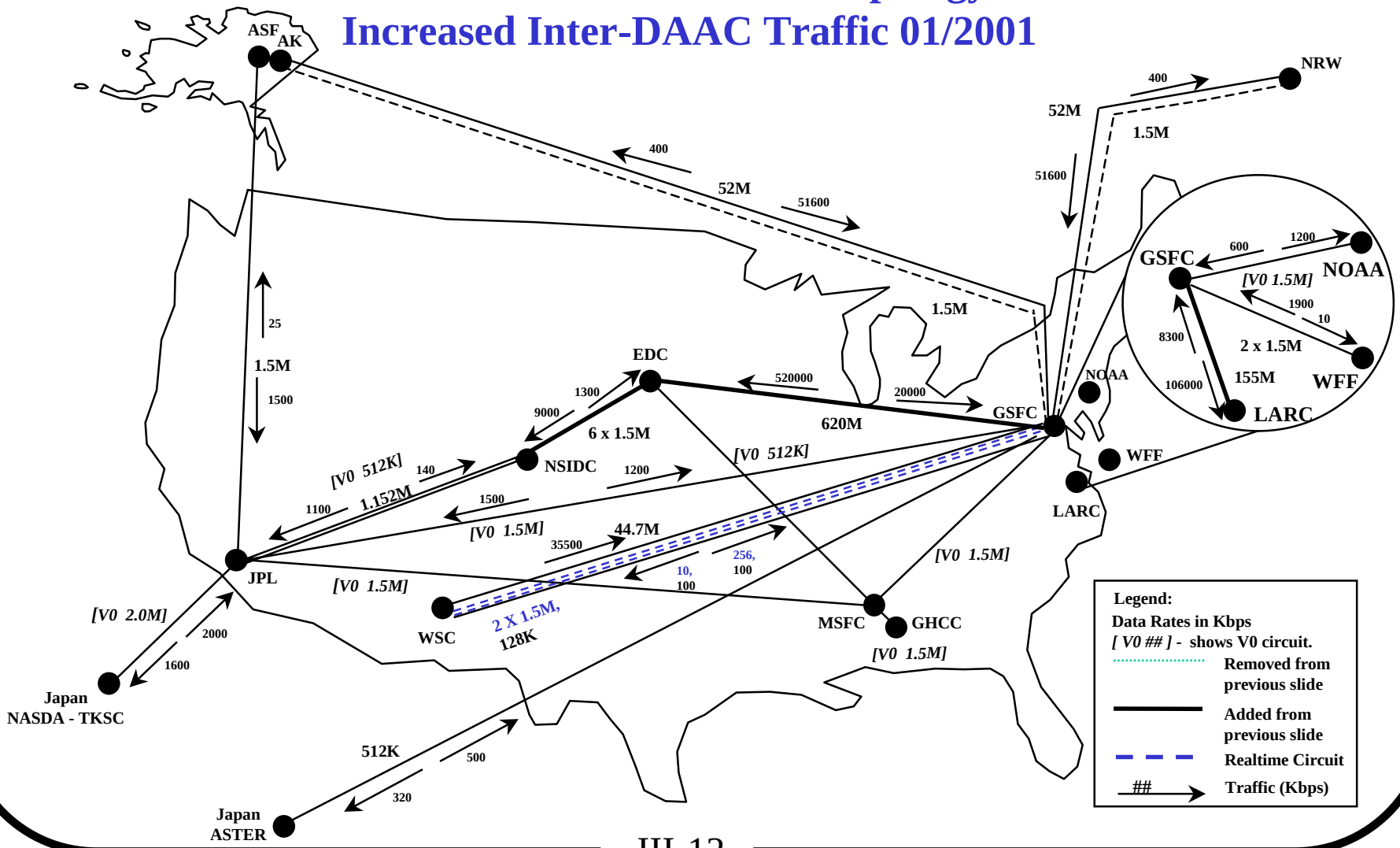
EBnet Wide Area Network Topology for High Latitude Support 06/2000



EBnet

Networks Review

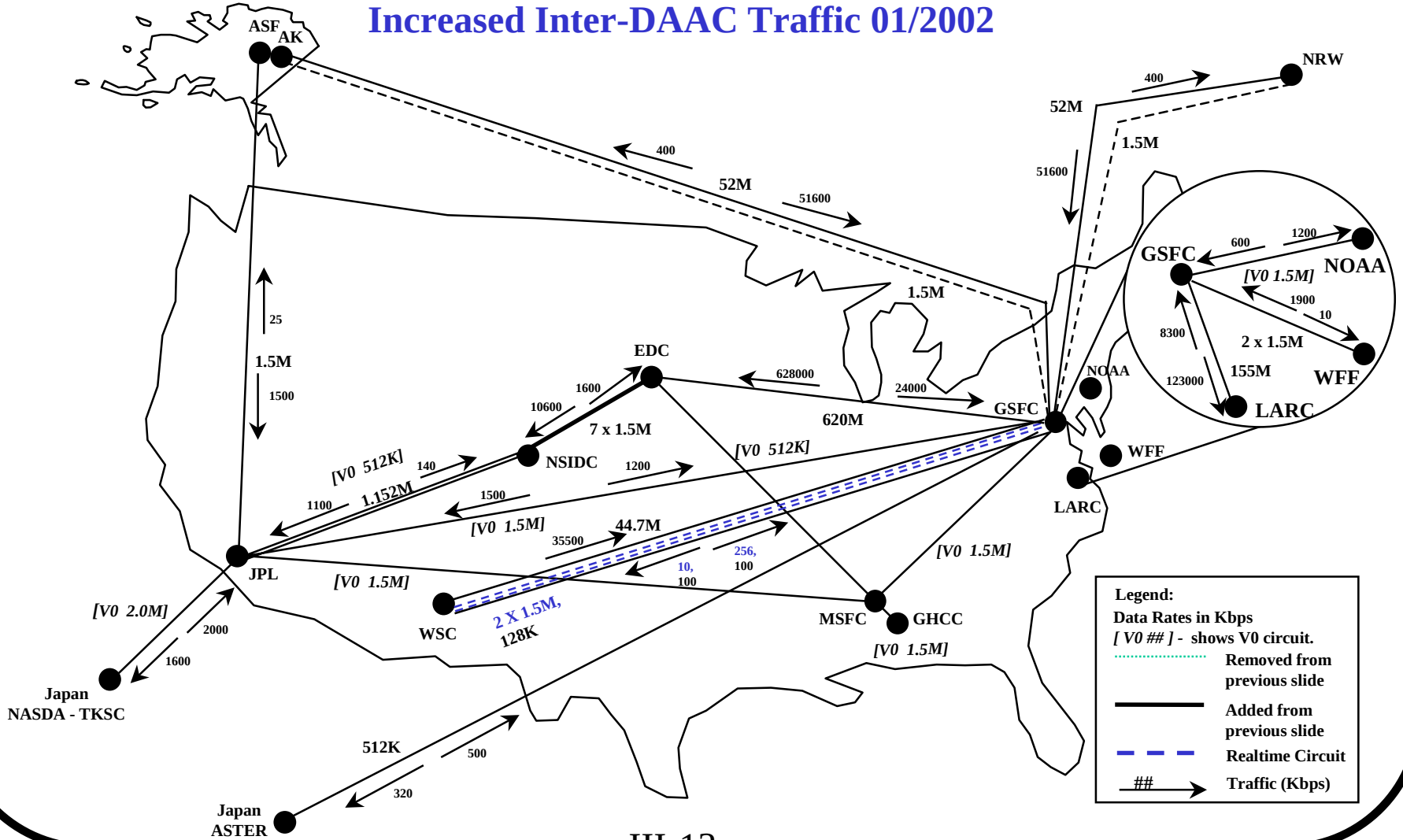
EBnet Wide Area Network Topology for Increased Inter-DAAC Traffic 01/2001



EBnet

Networks Review

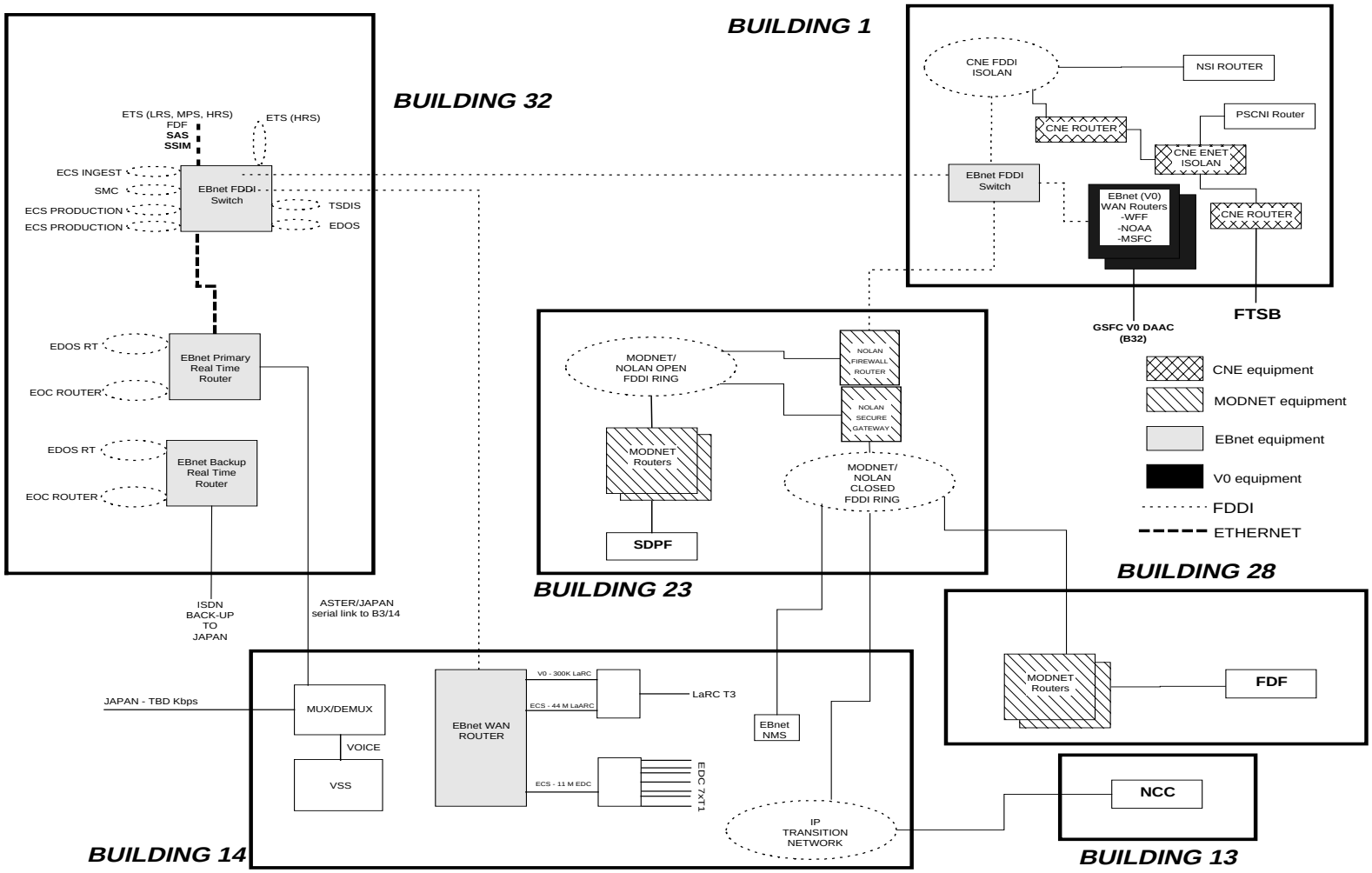
EBnet Wide Area Network Topology for Increased Inter-DAAC Traffic 01/2002



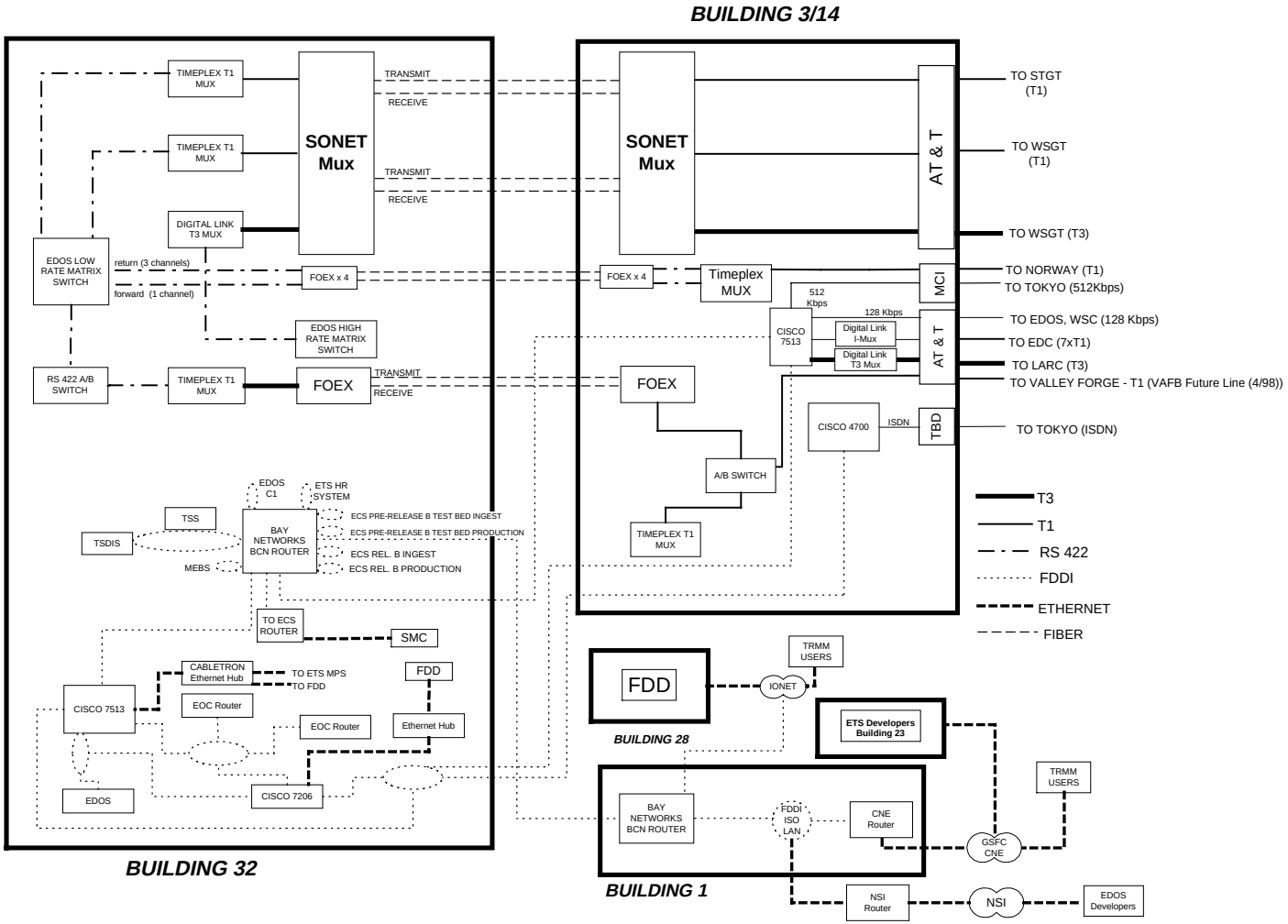
III.B. Site Designs

Chris Garman

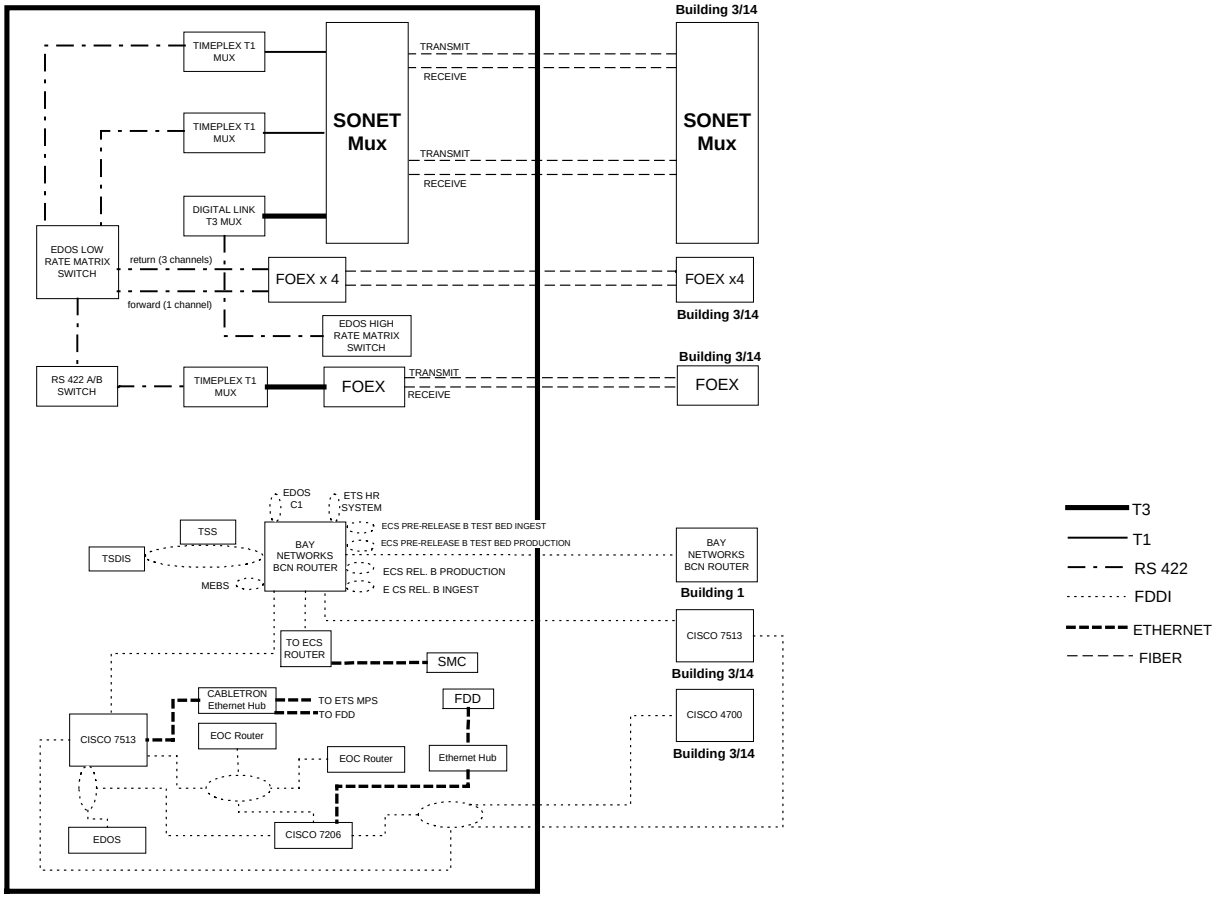
GSFC Site Design May 1996



GSFC Site Design November 1997

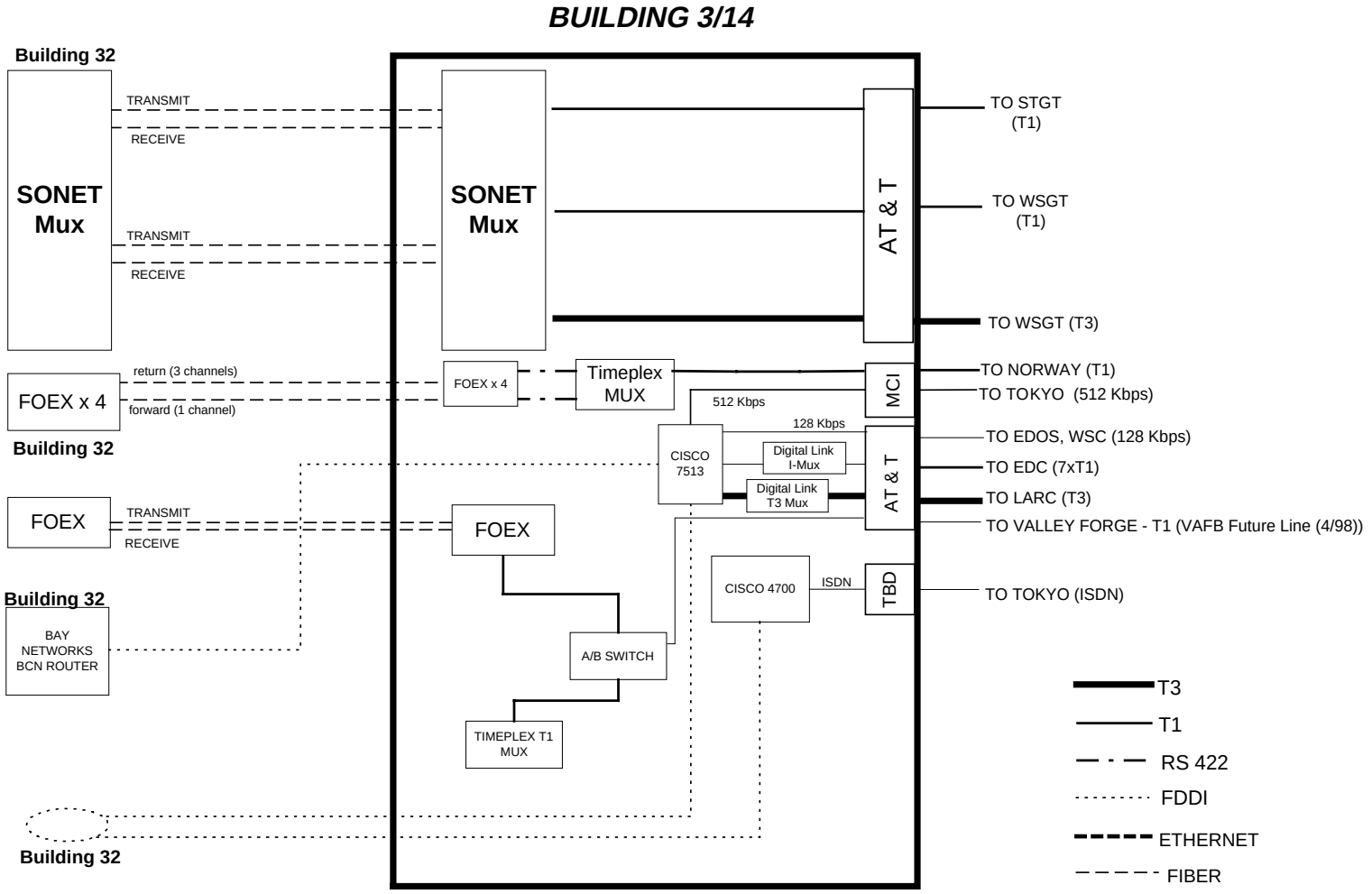


GSFC Site Design Building 32

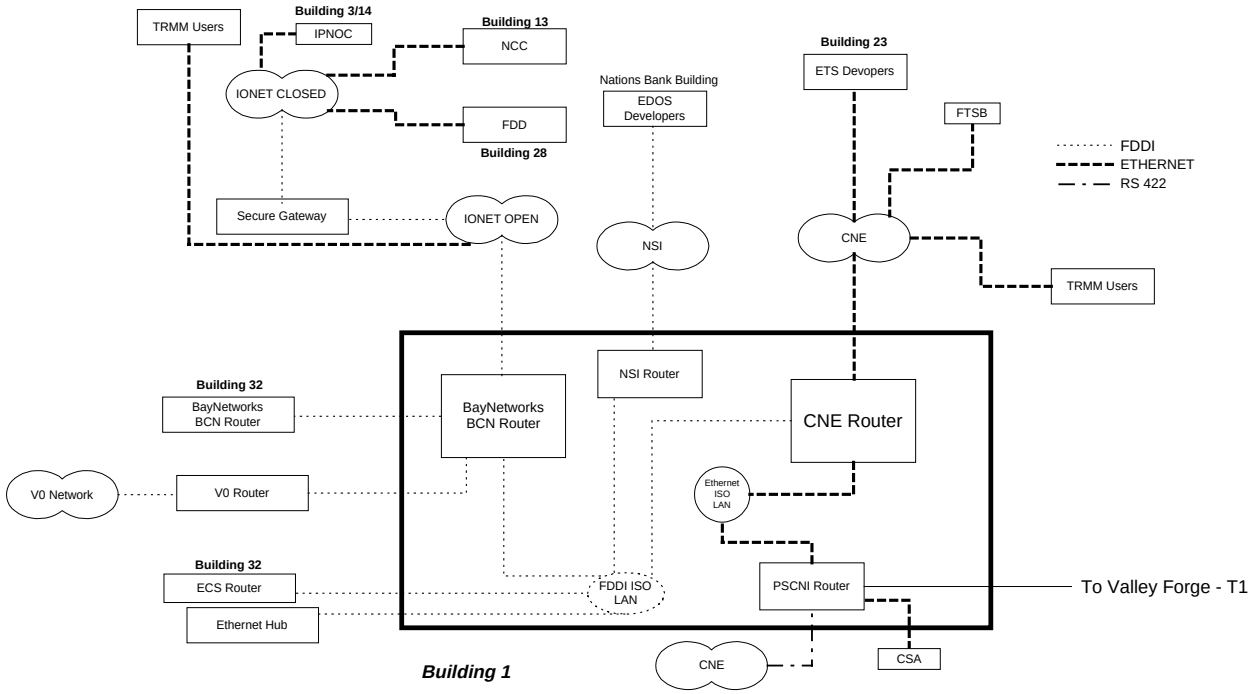


BUILDING 32

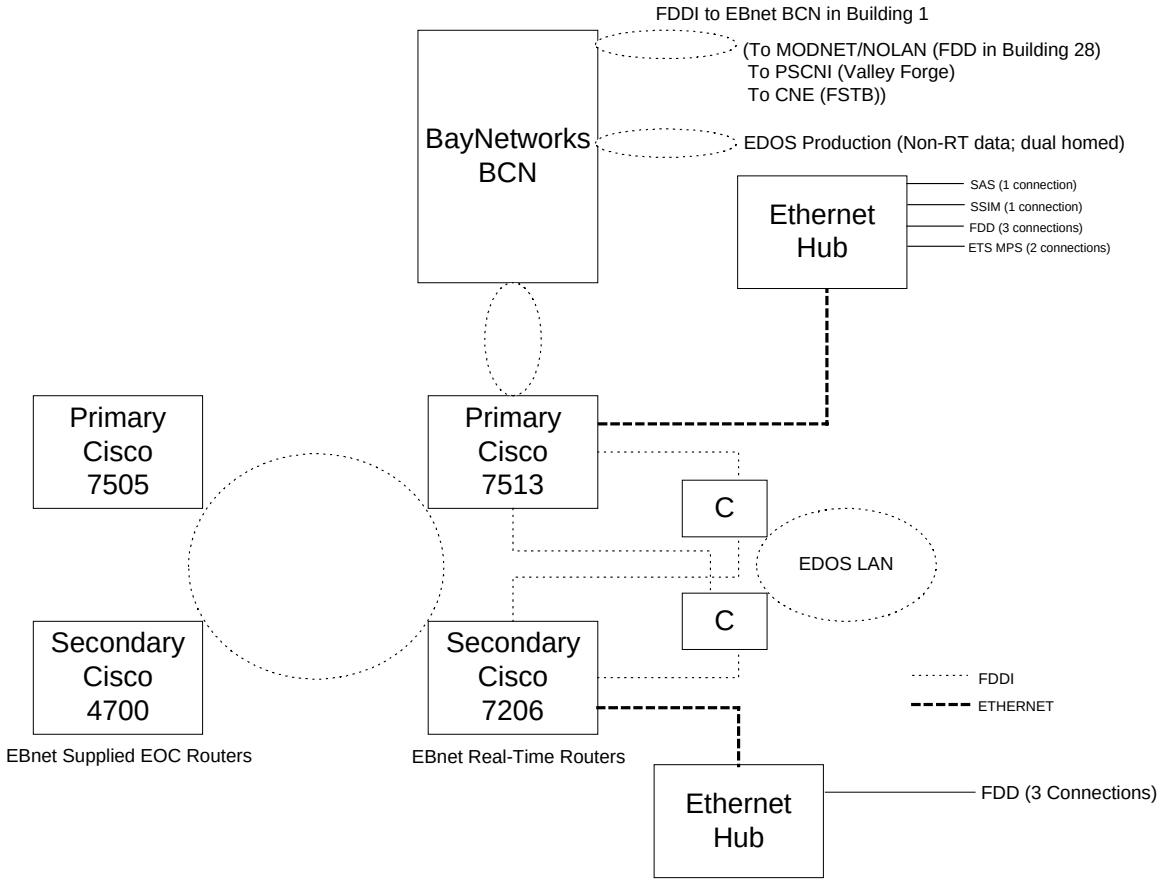
GSFC Site Design Building 3/14



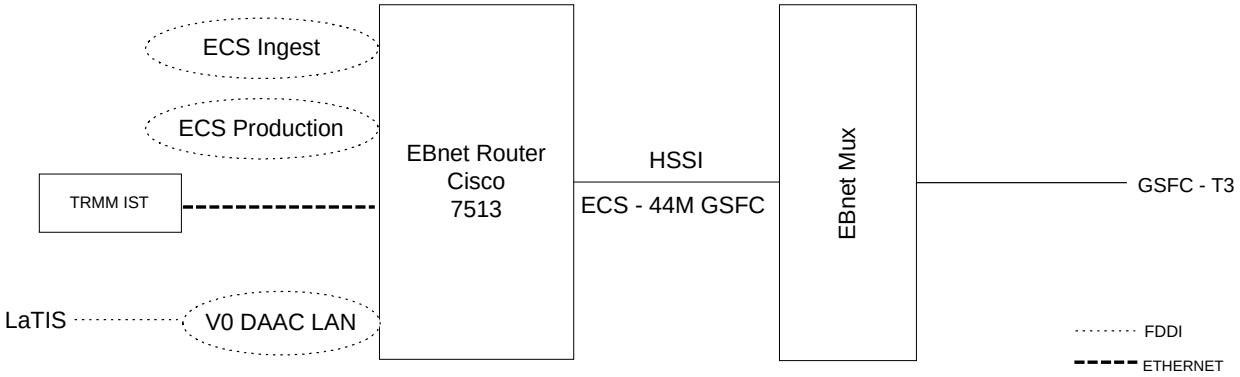
GSFC Site Design Building 1, 23, and 28



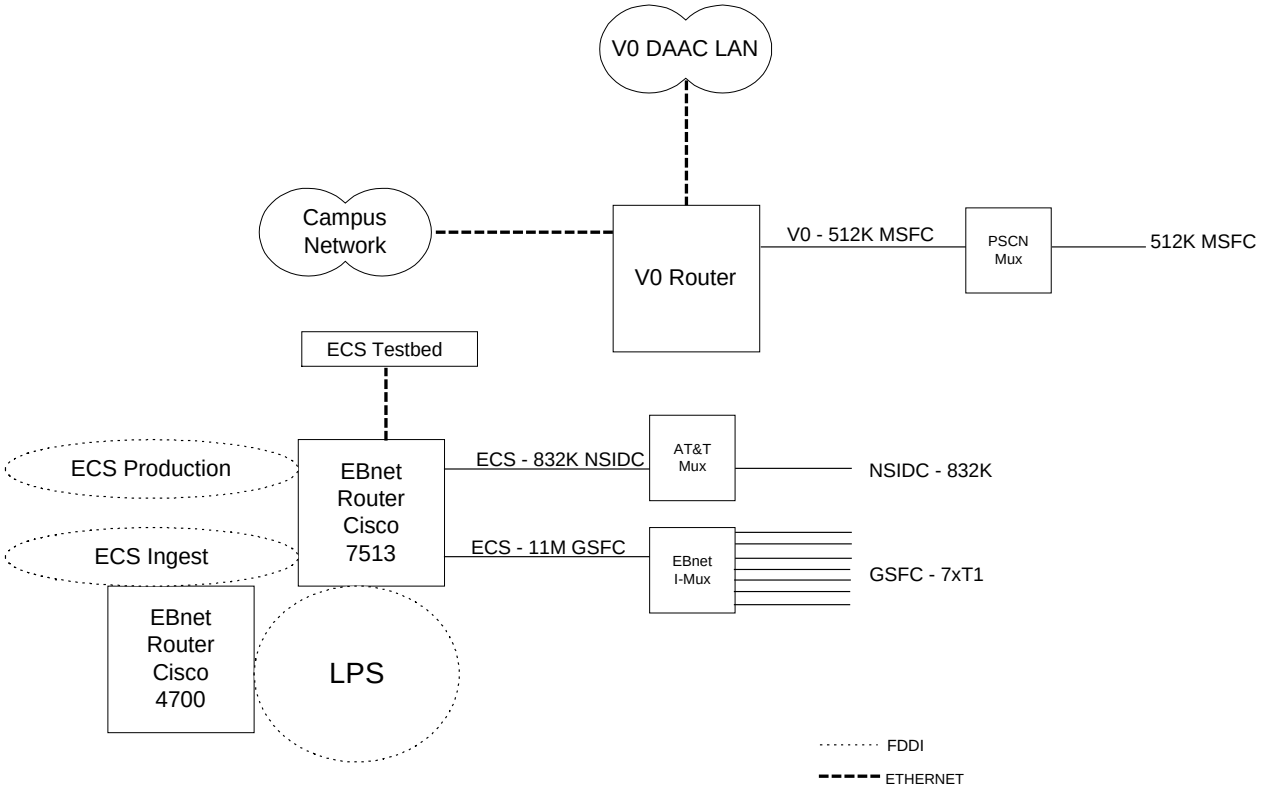
Implemented EOC Design



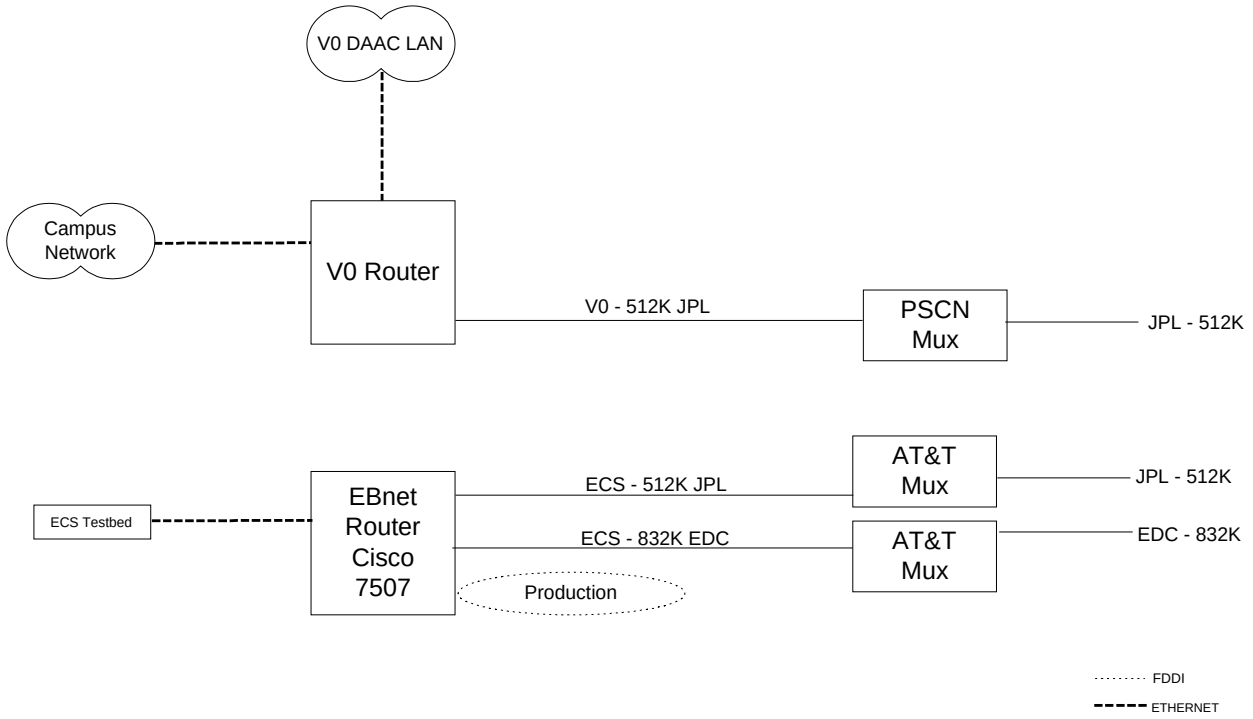
Implemented LaRC Node Design



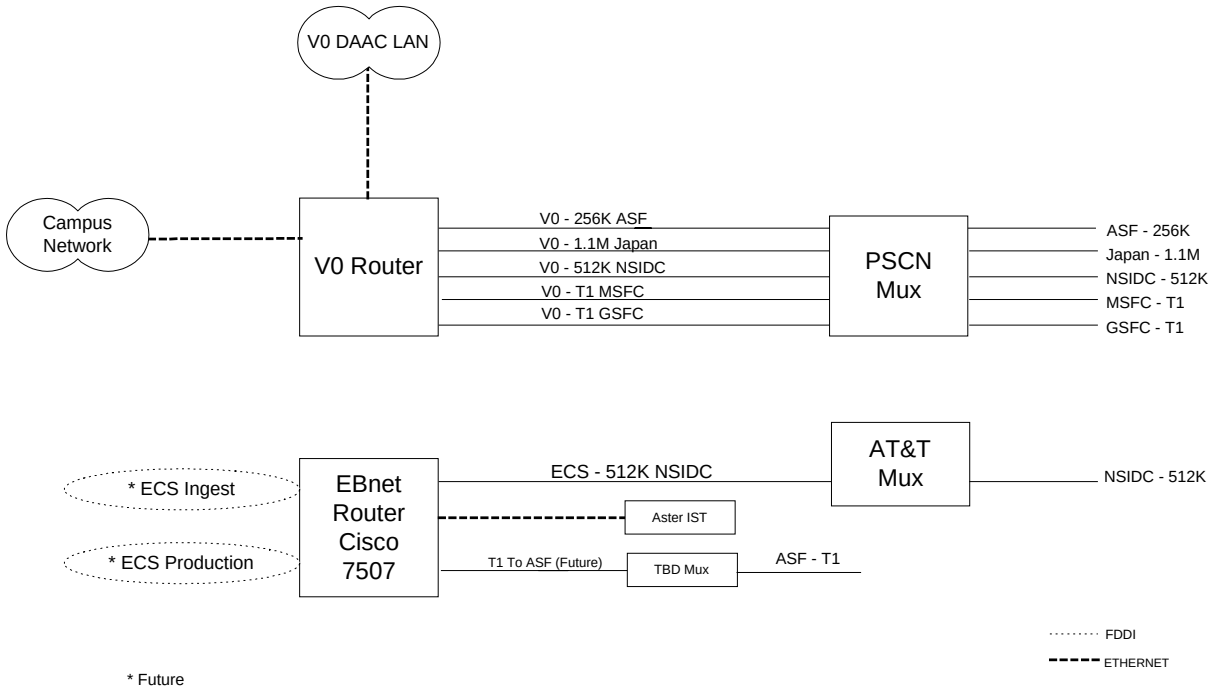
Implemented EDC Node Design



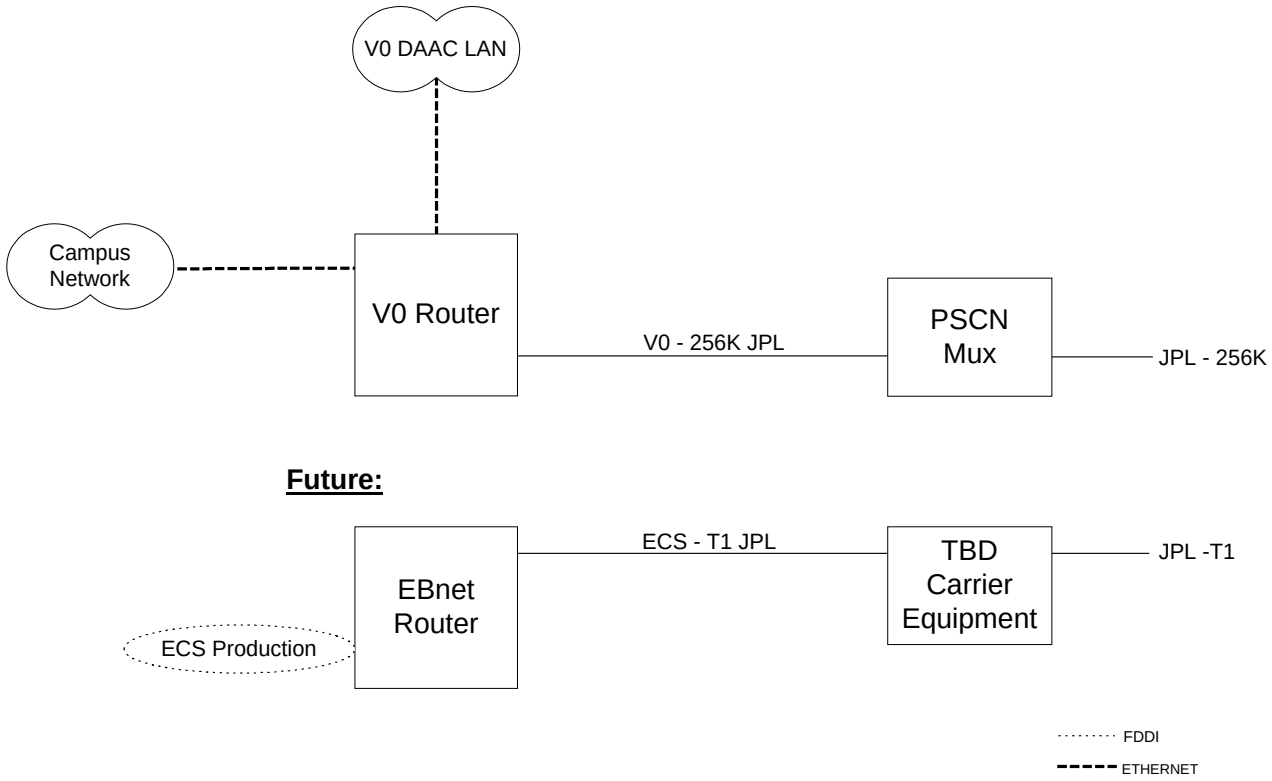
Implemented NSIDC Node Design



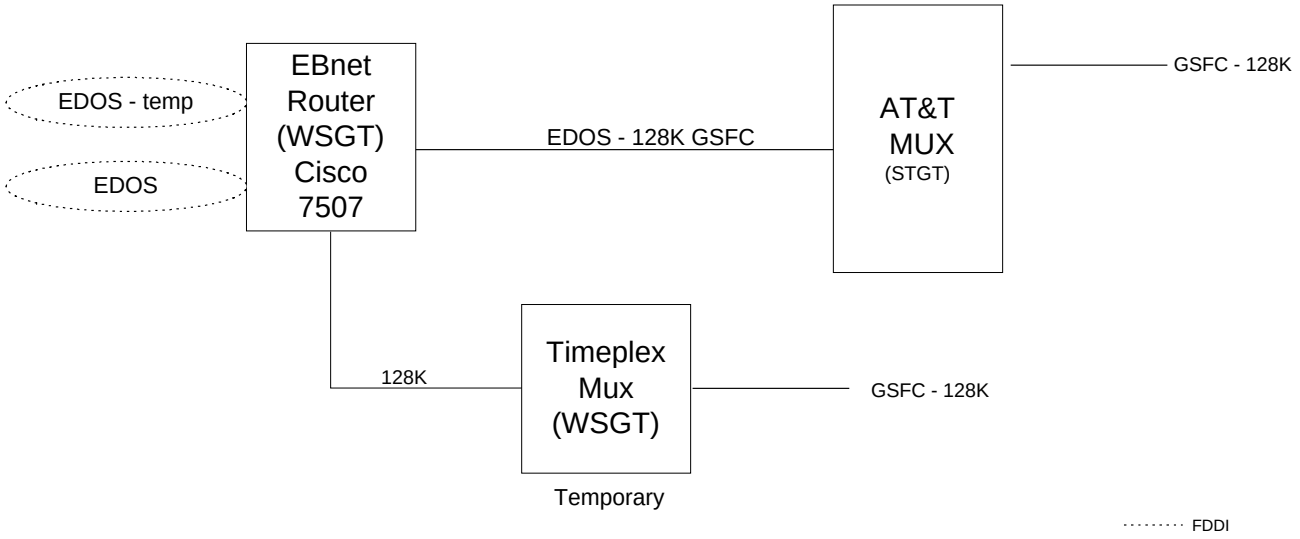
Implemented JPL Node Design



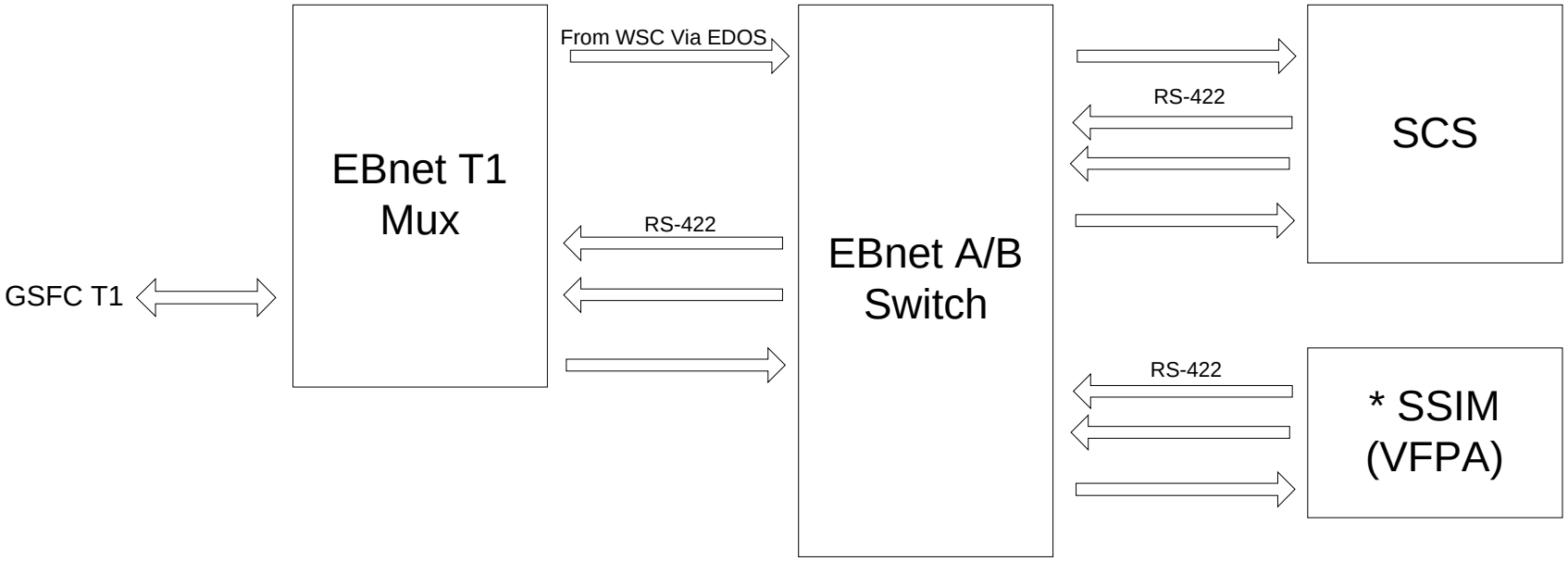
Implemented ASF Node Design



Implemented WSC Node IP Design

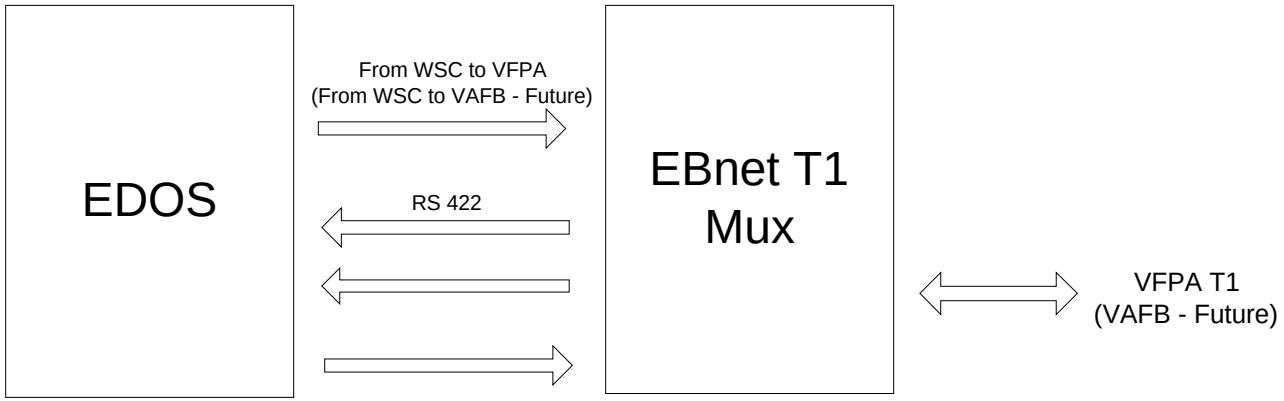


VFPA/VAFB Detailed Design for Clock/Data Return and Forward Link Flows

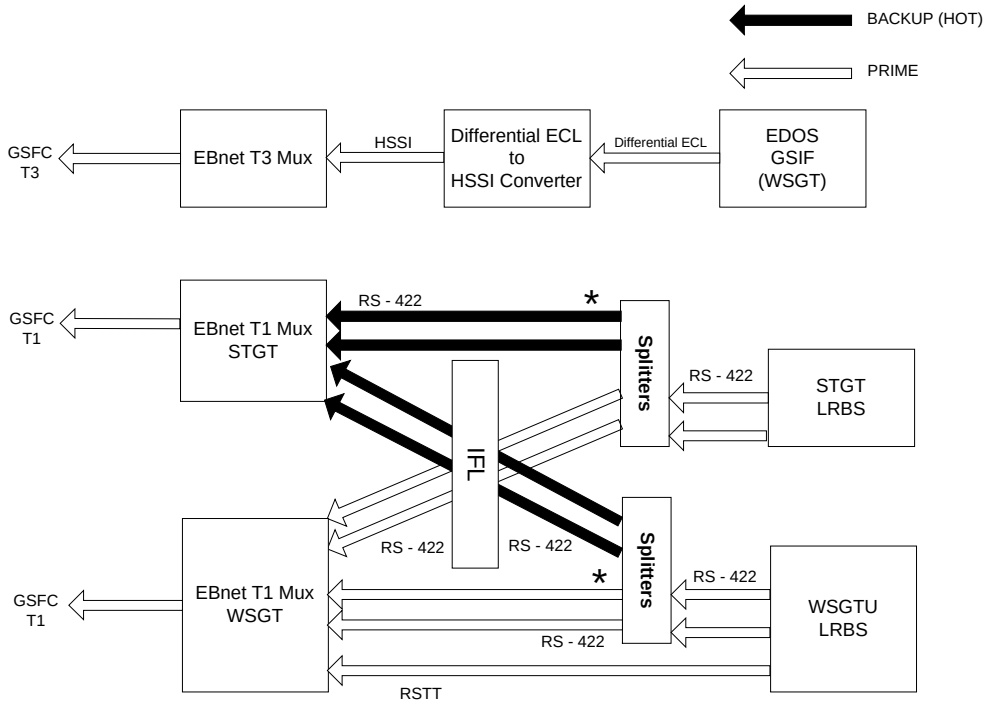


* Connection Terminated After AM-1 Shipment to VAFB

GSFC Detailed Design for Clock/Data Return and Forward Link Flows from VFPA/VAFB



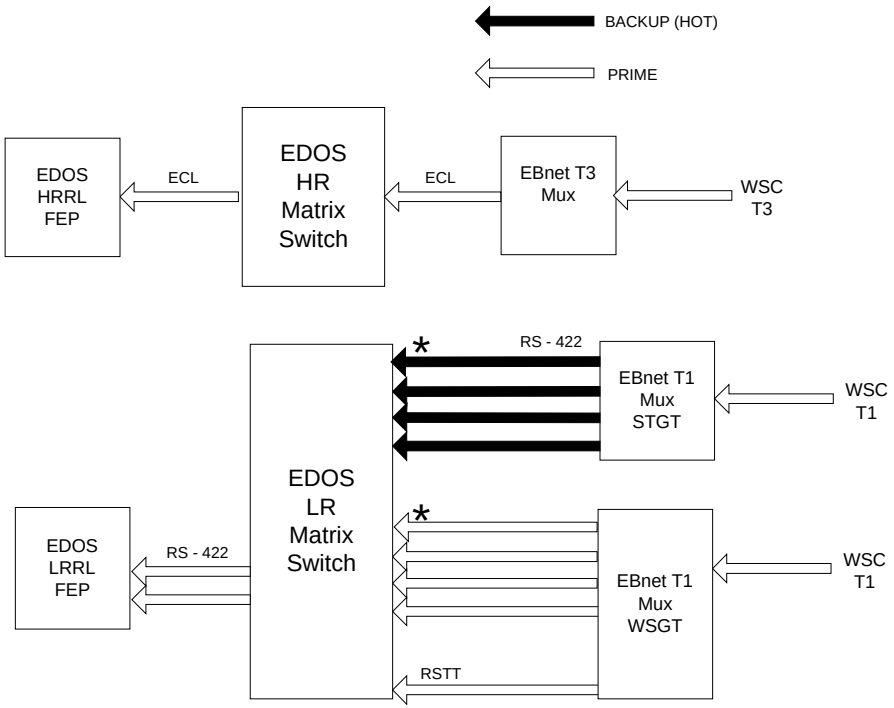
WSC Detailed Design for Clock/Data Return Link Flows



· LRBS - Low Rate Black Switch
· STGT - Second TDRSS Ground Terminal
· WSGTU - White Sands Ground Terminal Upgrade
· IFL - Inter-facility Link
· RSTT - Remote Site Time Transfer

* Total number of channels: 12

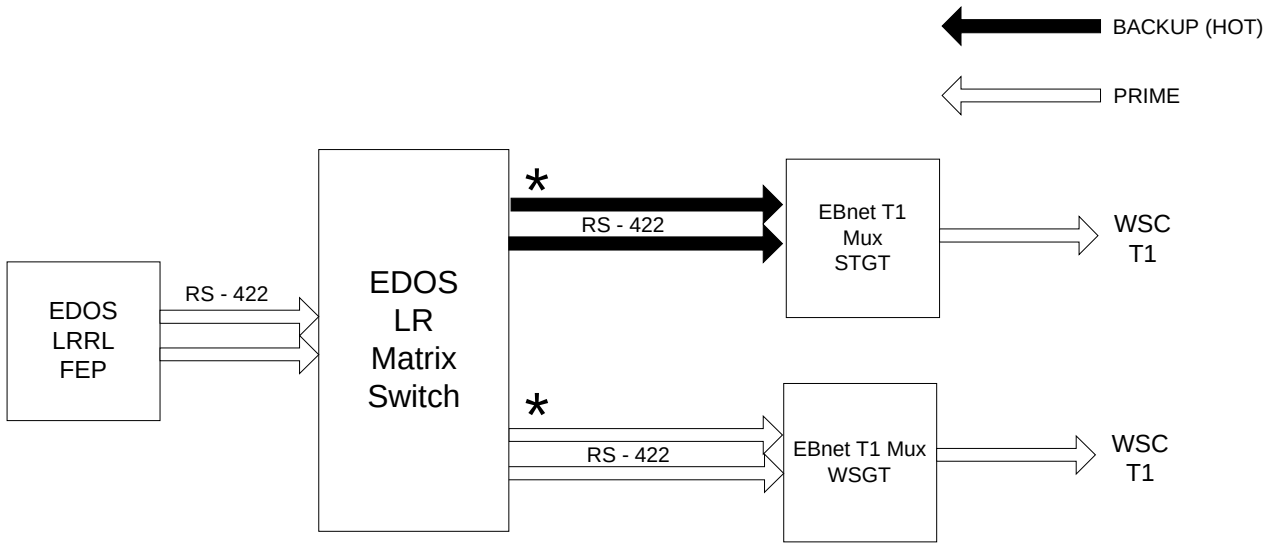
GSFC Detailed Design for Clock/Data Return Link Flows



· FEP - Front End Processor
· HRRL - High Rate Return Link
· LRRL - Low Rate Return Link
· RSTT - Remote Site Time Transfer

* Total number of channels: 12

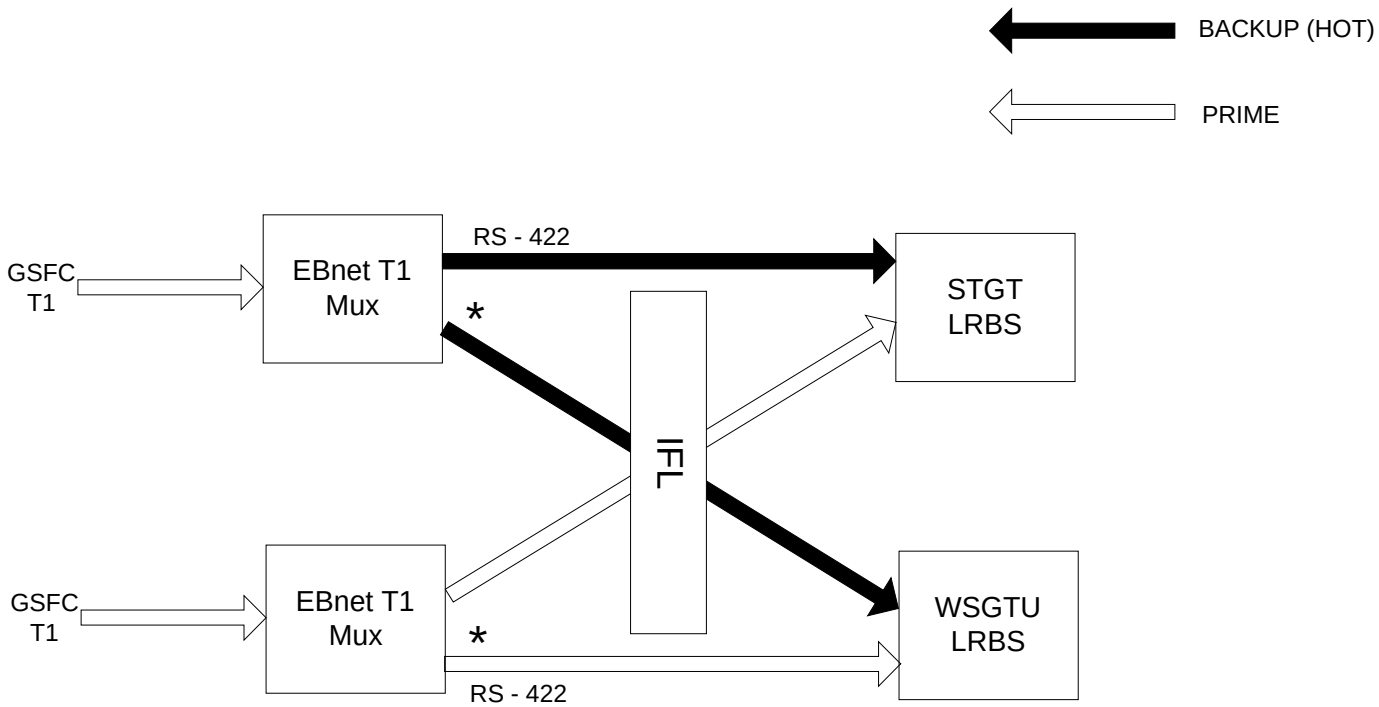
GSFC Detailed Design for Clock/Data Forward Link Flows



· LRBS - Low Rate Black Switch
· STGT - Second TDRSS Ground Terminal
· WSGTU - White Sands Ground Terminal Upgrade
· IFL - Inter-facility Link
· RSTT - Remote Site Time Transfer

* Total number of channels: 4

WSC Detailed Design for Clock/Data Forward Link Flows



* Total number of channels: 4

High Latitude Ground Stations

- Implemented in two phases
  - Phase I: Three ground stations (WFF; Poker Flat, AK; Longyearbyen, Norway) provide Landsat-7 prime support and AM-1 contingency support for low rate telemetry and commanding. AM-1 contingency science handled initially via tape shipment with ground communications implementation if requested by the project.
  - Phase II: Two ground stations (called EOSDIS Ground Stations with one at Poker Flat and one at Longyearbyen) provide EOS prime support for both low-rate and high-rate (science) operations.

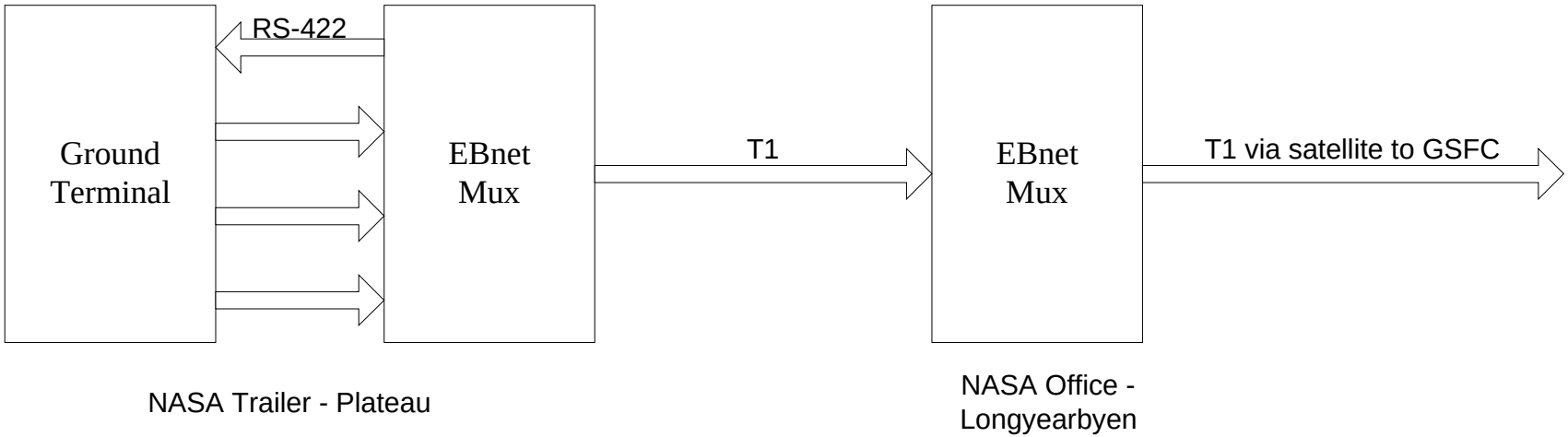
High Latitude Ground Stations (cont'd)

- During Phase I, EBnet provides contingency support over NISN infrastructure.
  - Norway: EBnet provided a Timeplex mux to enable support of clock and data requirements. Circuit is NISN-funded.
  - AK/WFF: Original plan was to utilize existing NISN muxes and circuits, but this was not achieved due to technical limitations of NISN muxes. Alternatives being examined include:
  - Use of EBnet PTP
    - Use of EBnet Timeplex mux over existing NISN circuit
    - Use of EBnet Timeplex mux over new EBnet circuit

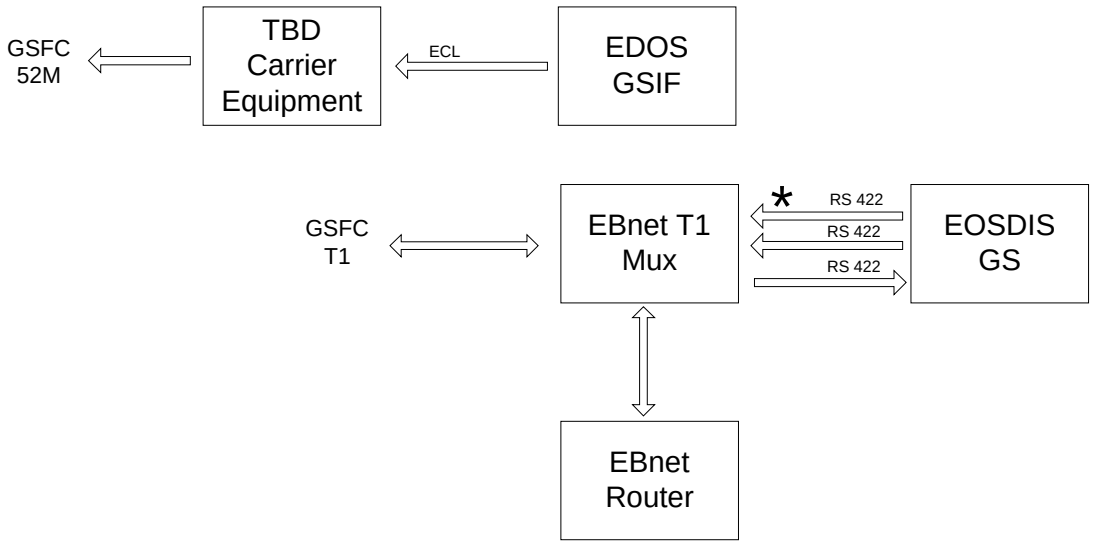
High Latitude Ground Stations (cont'd)

- During Phase II, EBnet provides prime support over EBnet infrastructure (circuits and end equipment).
- Low-rate data (forward and return) supported as clock/data from the EOSDIS Ground Station to EDOS LZPF.
- High-rate data (return only) support as clock/data from EDOS GSIF at the EOSDIS Ground Station to EDOS LZPF.
- Low-rate data services do not require hot circuit redundancy (4 hr MTTRS is acceptable).
- IP connectivity for command/control of ground equipment (both the EOSDIS Ground Station and the EDOS GSIF).
- Current need date defined to be 6/2000.

Svalbard Node Design

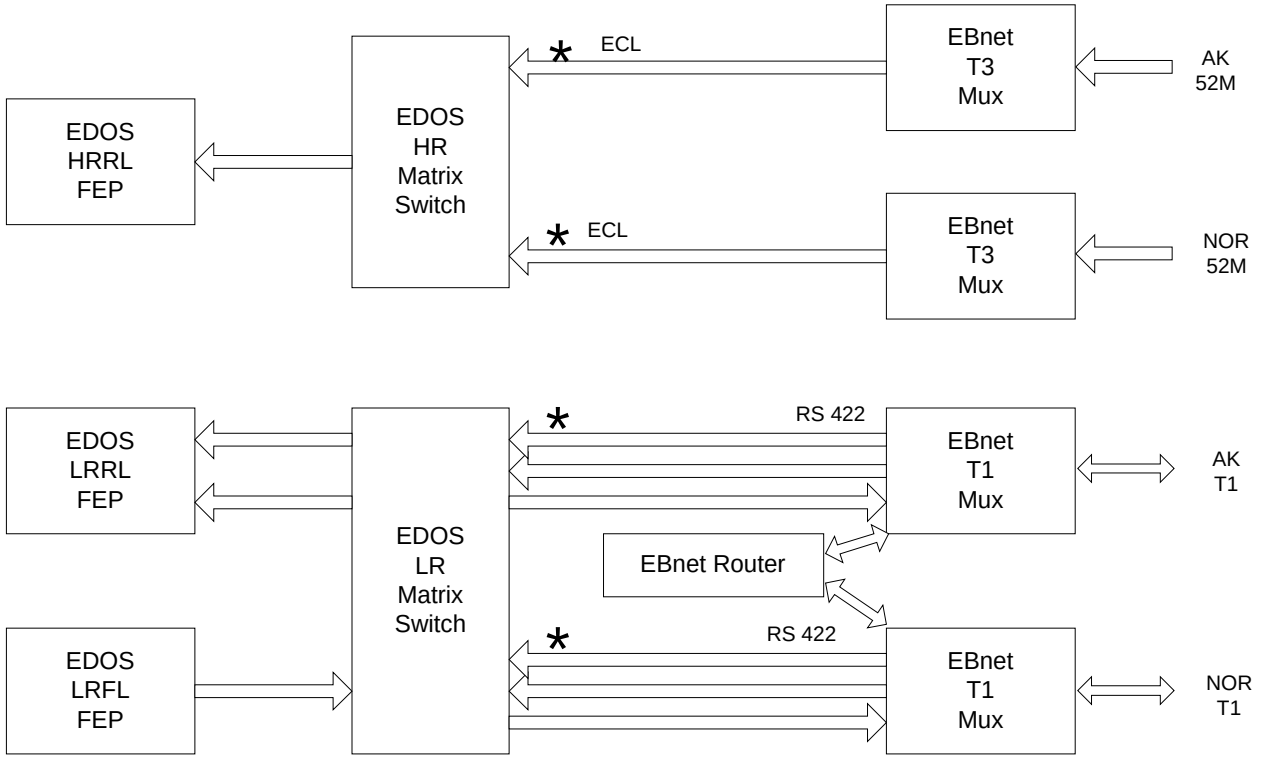


Alaska/Norway Detailed Future Design for Clock/Data Return and Forward Link Flows



* Total number of channels are TBD

GSFC Detailed Future Design for Clock/Data Return and Forward Link Flows from AK/NOR



* Total number of channels are TBD

III.C. Implementation

Chris Garman

Circuits Implemented to Date

- GSFC-LARC
  - T1 (originally 832K)
  - T3 Upgrade
- GSFC-VFPA T1
- GSFC-WSC
  - Two T1s
  - 128K Channel
  - T3
  - 44200K Satellite Link
- GSFC-EDC 7xT1
- NSIDC-JPL 512K
- EDC-NSIDC 832K
- GSFC-Tokyo (ASTER) 512K
- GSFC-EDF Connectivity (over existing ATM T3 service)

Nodes To Be Installed

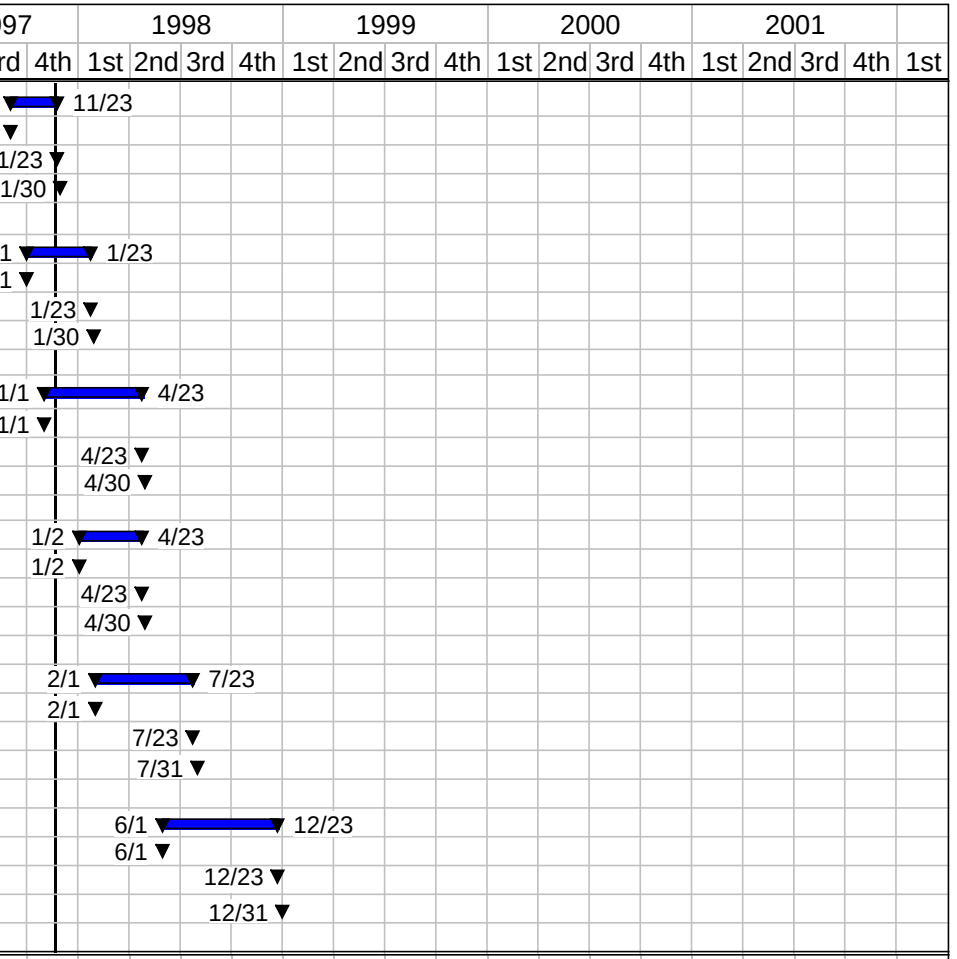
Node	Installation Date
VAFB	4/1998
WFF	7/1998
ASF	12/1998
Alaska	5/2000
Norway	5/2000

Circuits To Be Installed

CIRCUIT	IMPLEMENTATION DATE
GSFC - VFPA T3	11/1997
GSFC - Tokyo ISDN	1/1998
GSFC - VAFB T1	4/1998
GSFC - EDC T3	4/1998
GSFC - WFF T1	7/1998
GSFC - WFF additional T1	12/1998
JPL - ASF T1	12/1998
EDC - NSIDC T1 x 2 (upgrade from 832 Kbps)	12/1998
NSIDC - JPL 1.152 Mbps (upgrade from 512 Kbps)	12/1998
GSFC - EDC OC3	12/1998
NSIDC - EDC additional T1 x 2	12/1999
GSFC - EDC additional OC3	12/1999
GSFC - LaRC additional T3	12/1999
GSFC - Alaska T1	05/2000
GSFC - Norway T1	05/2000
GSFC - Alaska 52 Mbps	05/2000
GSFC - Norway 52 Mbps	05/2000
GSFC - LaRC OC3	12/2000
GSFC - EDC OC12	12/2000
EDC - NSIDC additional T1 x 2	12/2000
EDC - NSIDC additional T1	12/2001

EBnet Future Implementation Schedule

Task Name	Start Date	Finish Date
GSFC-VFPA T3 Circuit	**9/1/97**	**11/23/97**
Order Circuit	**9/1/97**	
Site Acceptance Test	**11/23/97**	
Need Date	**11/30/97**	
GSFC-Tokyo ISDN	**10/1/97**	**1/23/98**
Order Circuit	**10/1/97**	
Site Acceptance Test	**1/23/98**	
Need Date	**1/30/98**	
GSFC-VAFB T-1 Circuit	**11/1/97**	**4/23/98**
Order Circuit	**11/1/97**	
Site Acceptance Test	**4/23/98**	
Need Date	**4/30/98**	
GSFC-EDC T3 Circuit	**1/2/98**	**4/23/98**
Order Circuit	**1/2/98**	
Site Acceptance Test	**4/23/98**	
Need Date	**4/30/98**	
GSFC-WFF T1 Circuit	**2/1/98**	**7/23/98**
Order Circuit	**2/1/98**	
Site Acceptance Test	**7/23/98**	
Need Date	**7/31/98**	
GSFC-WFF T1 Circuit	**6/1/98**	**12/23/98**
Order Circuit	**6/1/98**	
Site Acceptance Test	**12/23/98**	
Need Date	**12/31/98**	

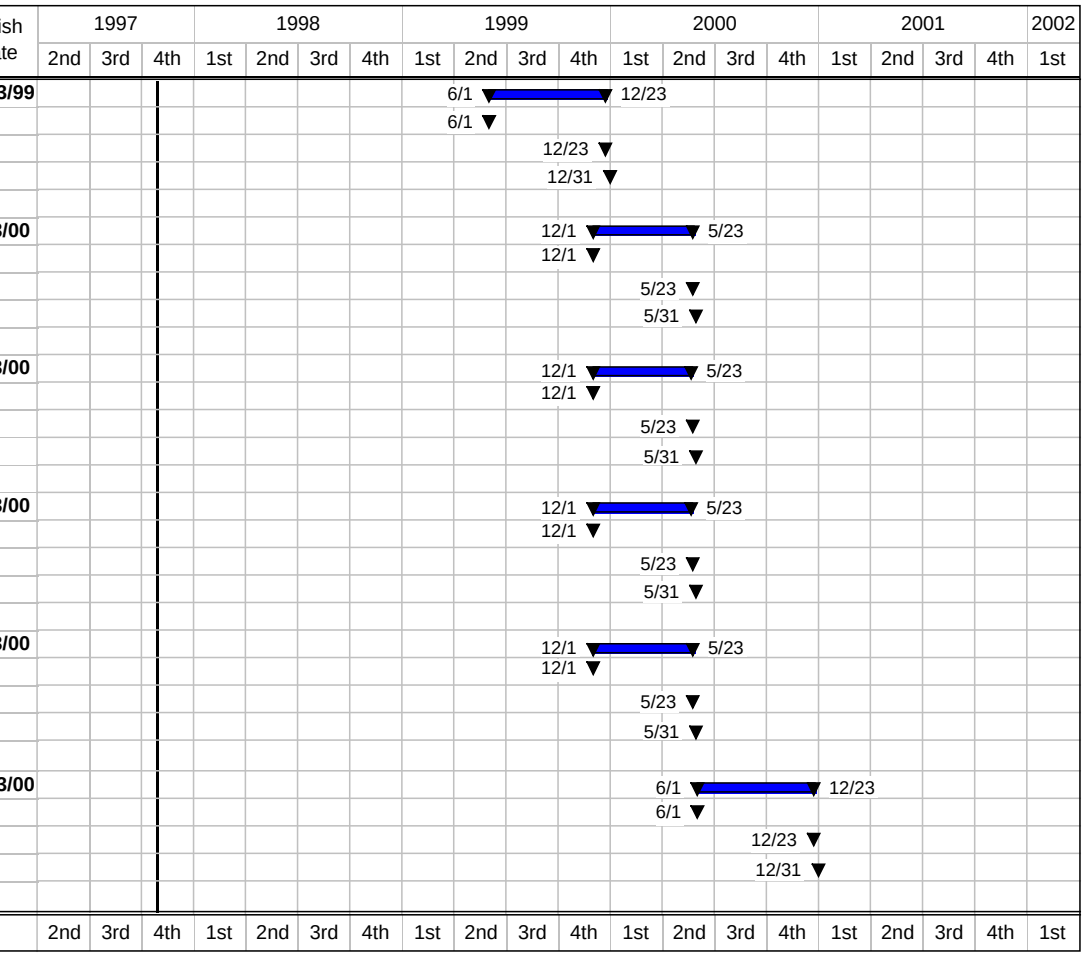


EBnet Future Implementation Schedule (cont'd)

Task Name	Start Date	Finish Date	1997			1998				1999				2000				2001				
			2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st
JPL-ASF T1 Circuit	**6/1/98**	**12/23/98**				6/1				12/23												
Order Circuit	**6/1/98**					6/1																
Site Acceptance Test	**12/23/98**							12/23														
Need Date	**12/31/98**							12/31														
EDC-NSIDC 2xT1	**6/1/98**	**12/23/98**				6/1				12/23												
Order Circuit	**6/1/98**					6/1																
Site Acceptance Test	**12/23/98**							12/23														
Need Date	**12/31/98**							12/31														
NSIDC-JPL 1.152M	**6/1/98**	**12/23/98**				6/1				12/23												
Order Circuit	**6/1/98**					6/1																
Site Acceptance Test	**12/23/98**							12/23														
Need Date	**12/31/98**							12/31														
GSFC-EDC OC3	**6/1/98**	**12/23/98**				6/1				12/23												
Order Circuit	**6/1/98**					6/1																
Site Acceptance Test	**12/23/98**							12/23														
Need Date	**12/31/98**							12/31														
EDC-NSIDC 2xT1	**6/1/99**	**12/23/99**								6/1				12/23								
Order Circuit	**6/1/99**									6/1												
Site Acceptance	**12/23/99**											12/23										
Need Date	**12/31/99**											12/31										
GSFC-EDC OC3	**6/1/99**	**12/23/99**								6/1				12/23								
Order Circuit	**6/1/99**									6/1												
Site Acceptance	**12/23/99**											12/23										
Need Date	**12/31/99**											12/31										
			2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st

EBnet Future Implementation Schedule (cont'd)

Task Name	Start Date	Finish Date
GSFC-LaRC T3	**6/1/99**	**12/23/99**
Order Circuit	**6/1/99**	
Site Acceptance	**12/23/99**	
Need Date	**12/31/99**	
GSFC- Alaska T1	**12/1/99**	**5/23/00**
Order Circuit	**12/1/99**	
Site Acceptance Test	**5/23/00**	
Need Date	**5/31/00**	
GSFC-Norway T1	**12/1/99**	**5/23/00**
Order Circuit	**12/1/99**	
Site Acceptance Test	**5/23/00**	
Need Date	**5/31/00**	
GSFC-Alaska 52M	**12/1/99**	**5/23/00**
Order Circuit	**12/1/99**	
Site Acceptance Test	**5/23/00**	
Need Date	**5/31/00**	
GSFC-Norway 52M	**12/1/99**	**5/23/00**
Order Circuit	**12/1/99**	
Site Acceptance Test	**5/23/00**	
Need Date	**5/31/00**	
GSFC-LaRC OC3	**6/1/00**	**12/23/00**
Order Circuit	**6/1/00**	
Site Acceptance Test	**12/23/00**	
Need Date	**12/31/00**	



EBnet Future Implementation Schedule (cont'd)

Task Name	Start Date	Finish Date	1997			1998				1999				2000				2001				2002
			2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st
GSFC-EDC OC12	**6/1/00**	**12/23/00**													6/1			12/23				
Order Circuit	**6/1/00**														6/1							
Site Acceptance Test	**12/23/00**																12/23					
Need Date	**12/31/00**																12/31					
EDC-NSIDC 2xT1	**6/1/00**	**12/23/00**													6/1			12/23				
Order Circuit	**6/1/00**														6/1							
Site Acceptance Test	**12/23/00**																12/23					
Need Date	**12/31/00**																12/31					
EDC-NSIDC T1	**6/1/01**	**12/23/01**																	6/1			12/23
Order Circuit	**6/1/01**																		6/1			
Site Acceptance Test	**12/23/01**																			12/23		
Need Date	**12/31/01**																			12/31		
			2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st

III.D. Testing

Patricia Perrotto

Testing

- EBnet Test Program
- EBnet Internal Test Overview
- External User Support
- EBnet Requirements Verification

EBnet Test Program

- Consists of both internal testing and support of external testing activities
- Internal testing program is comprised of:
  - Validating design functionality and performance
  - Performing acceptance testing.
- External test support includes supporting:
  - ESDIS Verification of AM-1 Mission System Test Requirements (MSTR)
  - DSNO Verification of Level 2 EBnet Requirements, Volume 6
  - EOSDIS Sister Project (e.g., ECS, EDOS, etc.) Testing
  - TRMM, Landsat-7, and AM-1 Project Testing.

EBnet Internal Test Overview

- Factory Acceptance Tests (FATs) provide the following:
  - EBnet design validation (transport and network management functions)
  - Government acceptance of the EBnet equipment.
- Site Integration and Acceptance Tests (SI&AT) provide the following:
  - Verification that each node is successfully integrated into the existing EBnet network using selected FAT procedures
  - Operational acceptance of the EBnet equipment.

External User Support

- EBnet has supported the following test activities:
  - Supporting and Observing Formal Project Integration and Test Milestones, for example: ECT-1 and ECT-2, TRMM Simulations, etc.
  - Supporting and Observing Various Project Engineering Tests, for example: EOC to Valley Forge Command Testing, Spacecraft Ku-band testing, etc.
  - Participation in ESDIS Test Integration & Certification Test Oversight Committee (TICTOC) and Integrated Product Team activities: review test plans, coordinate resources, and support test execution.
  - EBnet continued test support will include:
  - Continued support of TICTOC and Integrated Product Team activities
  - Providing required EBnet circuits to support testing
  - Ensuring EBnet network is available for testing efforts
  - Continue observation and support of project and end user tests.

EBnet Requirements Verification

- AM-1 MSTR Verification verifies requirements identified by the Flight Systems Test Team as critical to support AM-1 Project Tests and Operations.
- MSTR Verification will use the following evaluation methods:
  - Test: Observations made during EBnet External User Test Support
  - Analysis: Review of analyses and reports of system performance requirements criteria.
- Results of MSTR Verification Evaluation will be contained in a matrix that may be downloaded and/or reviewed from the EBnet web site.
- EBnet Project Office will support DSNO verification of requirements documented in the ESDIS Level 2 EBnet Requirements Document, Volume 6.

III.E. Network Management System

Karen Petraska-Veum

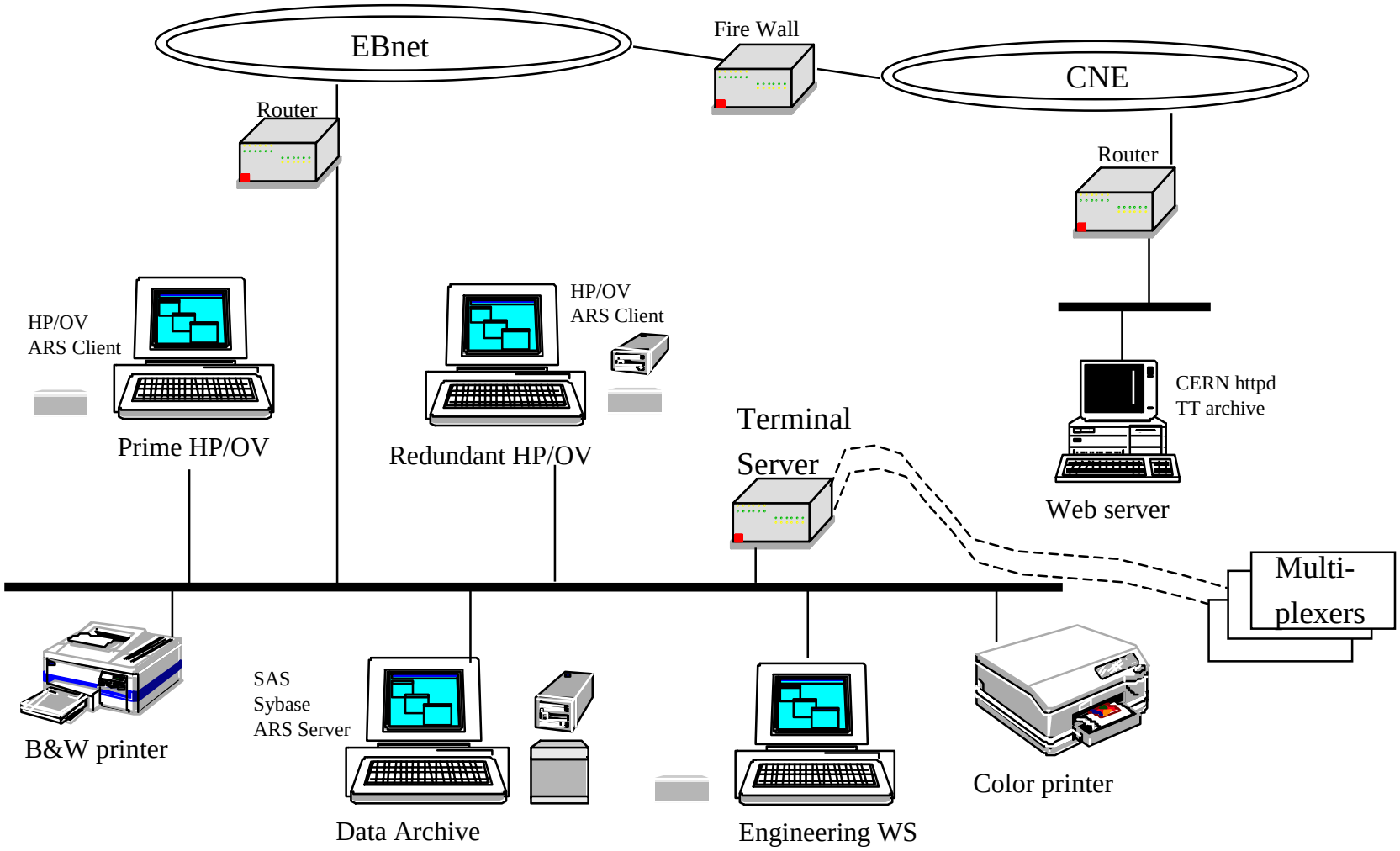
Overview

- Implementation Approach
- IPNOC Layout
- NMS Overview
- Implementation Status

Implementation Approach

- Phased, iterative implementation
  - Design and integrate in small pieces
  - Minimize customization through the extensive use of COTS
- System released in multiple deliveries
  - Prioritize functions for each delivery
  - Leverage on market trends
- Continue network management product testing and evaluation capability within NILE
- Future updates driven by evolution of COTS products and future customer requirements

IPNOC Layout



NMS Overview

- NMS is located in Nascom's IPNOC in GSFC Building 3/14.
- Platform is a set of Sun workstations running Solaris 2.5.1 with C2 security.
- Customized HPOpenView Network Node Manager v4.1.1
  - Primary and hot backup with automatic data sharing and operator controlled failover
  - Collecting data on utilization, for error monitoring and for trend analysis
  - Frequency of data collection based on line-speed
  - Real-time data reporting available for troubleshooting.

NMS Overview (cont'd)

- Customized Remedy Action Request System (Trouble Ticketing)
  - Reports available on classes of nodes
  - ECS-related Trouble Tickets available via WWW on EBnet web site
  - Trouble ticket exchange with participating EOSDIS sites using DSNO's interdomain trouble ticket exchange agreement
  - Sybase System 11 backend (Relational Database Management System with SQL)
- Statistical Analysis System (SAS) for report generation and performance analysis
  - HPOpenView data archived from primary to secondary and to SAS performance database every eight hours and then reduced
  - Data is further reduced weekly, monthly, and yearly

NMS Overview (cont'd)

- Engineering workstation containing tools for configuration control and more advanced trouble shooting and performance analysis
- System is connected on the closed side of Nascom Operational LAN (NOLAN) behind the secure firewall
  - Operating systems implement C2 security
  - SMTP, SNMP, SNMP trap and ICMP passed through the firewall
  - System uses tcpwrappers for additional security
- EBnet multiplexers connected to terminal server and managed through an ASCII interface
- Traffic utilization information routinely made available through the EBnet web site

Implementation Status

- NMS operational and in use supporting network operations since December 1996
- Making continued refinements based on new releases and upgrades of COTS software, new requirements and usage
- Completing testing of multiplexer management; staff have been trained on multiplexers
- Implementing new value-added features as identified and deemed appropriate

IV. Operations Concept

Karen Petraska-Veum

High Level Operations Concepts

- Staffing
- Roles and Responsibilities
- Escalation Process
- IPNOC Workflow
- EOSDIS Inter-domain Information Exchange

Staffing

- Comm Manager (24x7 on site)
- Network Operations Center (IPNOC)
  - Network Operators (24x7 on site)
  - Network Engineers (8x5 on site, 24 hour on-call)
- At other sites:
  - Agreements with DAAC staff and local site personnel (8x5 on site, 24 hour on-call)
  - Vendor support (4 hour response, 24 hour part replacement)

Roles and Responsibilities

- Comm Manager
  - Coordination of information and events across all Nascom elements including EBnet
- Network Operators
  - Working knowledge of all applications, operating systems, and networks
  - Interface with customers and users to isolate, diagnose, and resolve problems
- Network Engineers
  - All functions performed by operators
  - Second-tier troubleshooting and problem resolution
  - Understand system-wide issues
  - Resolve all open problems

Escalation Process

- First tier: Operators
- Second tier: Network Engineers
- Third tier: Vendor maintenance and technical troubleshooting agreements

EBnet

Networks Review

IPNOC Workflow

HPOV/Operator observation, user call to Comm Manager

Problem Alert!!!

Open Trouble Ticket!

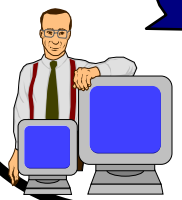
Operator troubleshoots to isolate/resolve problem

Involves engineers, carriers, remote site personnel and vendors as necessary

Operator closes trouble ticket when problem is resolved

IPNOC Operator

IPNOC keeps Comm Manager informed



Comm Manager interfaces between users and IPNOC and keeps all parties informed!

IPNOC Workflow

- The Comm Manager is the focal point for information exchange and coordination across all Nascom systems. The Comm Manager coordinates with the IPNOC and they keep each other informed of status.
- Users will report problems directly to the Comm Manager.
- Operators troubleshoot problems and route trouble tickets through the system as necessary to engineers, carriers or vendors.
- Operators are informed at all times of problem/solution status.
- Remedy automatically escalates problems not resolved within predefined time constraints.

EOSDIS Inter-domain Information Exchange

- All EBnet trouble tickets and status updates will be made available on the EBnet web site.
- EBnet Trouble Tickets will be distributed electronically to the SMC, EDOS, the LSMs and the EOC
  - Interdomain exchange will use Remedy's email-based trouble ticket exchange mechanism utilizing the EMC's common Remedy transfer schema whenever possible.
- EBnet will accept electronic Trouble Tickets via email and using the transfer schema.
- Circuit utilization information will be available on the EBnet web site.

V.A. NASA Networking Activities

Chris Garman

NSAP-II Contract

- NSAP-II modification to the FTS-2000 contract would have allowed procurement of IP services from AT&T.
- AT&T would have provided day-to-day operation of the Mission IP network.
- MCI protested the contract; the protest has been upheld.
- We will continue to order domestic circuits from AT&T through NSAP-I with open competition on Non-FTS2000 circuits.
- Hughes STX will continue to operate the Mission IP network until approximately 9/98.
- Tasking for engineering and installation support will be through a combination of CNMOS and Program Information Systems Management Services (PrISMS) contracts.
- Commercialization of all NISN IP networks will be pursued under other contractual vehicles.

NISN

- NASA Integrated Services Network (NISN) is continuing to take shape.
- EBnet is formally considered as part of NISN.
- Working relationship between EBnet and ESDIS is in transition.
  - EBnet System Engineer reports directly to Mission Systems Networks Manager as a dedicated resource.
  - NISN Service Manager for MTPE taking more of an active role in the requirements management area.
  - Use of PrISMS contractor provides more direct NISN engineering support.
  - NISN management receiving weekly EBnet status.
  - For FY98, MSFC will be paying all NISN circuit bills. Code 240 will forward sufficient funds to MSFC out of the Code 423 EBnet budget allocation.

V.B. Outstanding Issues
Chris Garman

FY98 Issues

- Staffing: losses due to RIFs at the subcontractor level have left the project with minimal support in Timeplex mux and rack fabrication areas.
  - Mitigation: utilize PrISMS resources to the maximum extent possible to supplement existing CNMOS resources. Utilize Ops contractor (Hughes STX) to supplement Timeplex tasks.
- Requirements growth: every month brings new requirements that have short fuses (EDF connectivity, VF T3 circuit, TRMM recovery support, EDC prototype, redundant FDF LAN, 2nd WSC T3 link, 2nd WSC IP link) impacting our ability to meet existing requirements.
  - Mitigation: same as above. In addition, any hardware funding shortfalls can be addressed through use of lab hardware.
- Alaska and Wallops contingency requirements support: Use of existing AT&T infrastructure is not technically feasible.
  - Mitigation: recovery designs are under consideration.
- EBnet WSC clock/data infrastructure has a number of deficiencies at this time.
  - Mitigation: A batch of defective cards will be replaced at the end of November.
  - Exchange of IFL equipment, at the end of January, will remedy issue relating to the data rate changes.
- PM-1 clock/data requirement changes do not match current design.
  - Mitigation: Test PTP devices for potential use. Work closely with EDOS to finalize working design.

VI. Conclusion
Chris Garman

Conclusion

- EBnet has not consolidated the V0 and EBnet infrastructures sufficiently. It is recommended that consolidation be performed by NISN as part of the larger NASA network consolidation.
- EBnet IP infrastructure is sufficient to support the AM-1 and Landsat-7 launches.
- FY98 work can be achieved with current staffing levels. Assumes that no significant new requirements are levied.

Acronyms

ADEOS	Advanced Earth Observing Satellite
AGS	Alaska Ground Station
AHWGP	Ad-Hoc Working Group on Production
AK	Alaska
ARC	Ames Research Center
ASF	Alaska SAR Facility
ASTER	Advanced Spaceborne Thermal Emission and Reflection Radiometer
BER	Bit Error Rate
CCR	Configuration Change Request
CDRL	Contract Data Requirements List
CNE	Center Network Environment
CNMOS	Consolidated Network and Mission Operations Support
CSA	Canadian Space Agency
DAAC	Distributed Active Archive Center
DCN	Document Change Notice
DID	Data Item Description
DIS	Data Information System
DMR	Detailed Mission Requirements
DSN	Deep Space Network
DSNO	Distributed Systems & Network Office
EBnet	EOSDIS Backbone Network
ECL	Emitter Coupled Logic
ECS	EOSDIS Core System
ECT	EOS Compatibility Test
EDC	Earth Resources Observation Station (EROS) Data Center
EDF	ECS Development Facility
EDOS	EOS Data & Operations System
EDS	Expedited Data Set
EOC	EOS Operations Center
EOP	EDOS Operational Prototype
ERSDAC	Earth Resources Satellite Data Analysis Center
EOS	Earth Observing System
EOSDIS	Earth Observing System Data & Information System

Acronyms

ESDIS	Earth Science Data & Information System
ETS	EOSDIS Test System
FDD	Flight Dynamics Division
FDF	Flight Dynamics Facility
FSTB	Flight Software Testbed
FTS	Federal Telecommunications System
GB	Gigabyte
GDS	Ground Data System
GHCC	Global Hydrology Change Center
GN	Ground Network
GSFC	Goddard Space Flight Center
GSIF	Ground Station Interface Facility
GSE	Ground Support Equipment
GT	Ground Terminal
HCI	Human Computer Interface
HITS	Hughes Information Technology Systems
HRS	High-Rate System
HPOV	Hewlett Packard OpenView
HSSI	High Speed Serial Interface
IAS	Image Assessment System
ICD	Interface Control Document
ICMP	Internet Control Message Protocol
IFL	Inter-Facility Link
IONET	IP Operational Network
IP	Internet Protocol
IPNOC	IP Network Operation Center
IR	Interim Release
IRD	Interface Requirements Document
IST	Instrument Support Terminal
LIS SCF	Light Imaging Sensor Science Computing Facility
JPL	Jet Propulsion Laboratory
Kbps	Kilobits per second
Landsat	Land Remote Sensing Satellite
LPS	Landsat Processing System
LaRC	Langley Research Center
LRS	Low Rate System
LaTIS	Langley TRMM Information System

Acronyms

LSM	Local System Management
LZPF	Level Zero Processing Facility
Mbps	Megabits per second
MO&DSD	Mission Operations & Data System Directorate
MOC	Mission Operations Center
MODNET/	MO&DSD Operational Development Network
NOLAN	Nascom Operations Local Area Network
MPS	Multimode Portable Simulator
MSFC	Marshall Space Flight Center
MTPE	Mission To Planet Earth
MSTR	Mission System Test Requirement
MTTRS	Mean Time to Restore Service
Mux	Multiplexer
NASA	National Aeronautics and Space Administration
Nascom	NASA Communications
NASDA	National Space Development Agency of Japan
NCC	Network Control Center
NESDIS	National Environmental Satellite Data and Information System
NISN	NASA Integrated Services Network
NMS	Network Management System
NOAA	National Oceanic and Atmospheric Administration
NOC	Network Operations Center
NRWY	Norway
NSAP	Network Space Assurance Plan
NSIDC	National Snow and Ice Data Center
NTR	Nascom Traffic Requirement
NTRD	NISN Traffic Requirements Database
OSI	Open Systems Interconnection
PrISMS	Program Information System Management Services

Acronyms

PSCN	Program Support Communications Network
PTP	Programmable Telemetry Processor
RADARSAT	Radar Satellite (Canada)
RIF	Reduction In Force
SAR	Synthetic Aperture Radar
SAS	Statistical Analysis System
SCS	Spacecraft Checkout System
SDF	Software Development Facility
SDPF	Science Data Processing Facility
SDPRB	Science Data Processing Review Board
SGS	Svalbard Ground Station
SI&AT	Site Integration & Acceptance Test
SMC	Systems Monitoring and Coordination Center
SMTP	Simple Mail Transfer Protocol
SNMP	Simple Network Management Protocol
SSIM	Spacecraft Simulator
TBD	To Be Determined
TDRSS	Tracking Data Relay Satellite System
TKSC	Tsukuba Space Complex
TICTOC	Test Integration and Certification Test Oversight Committee
TGT	TDRSS Ground Terminal
TRMM	Tropical Rainfall Measuring Mission
TSDIS	TRMM Science Data Information System
TSS	TRMM Support System
VAFB	Vandenburg Air Force Base
VFPA	Valley Forge, Pennsylvania
WAN	Wide Area Network
WFF	Wallops Flight Facility
WOTS	Wallops Orbital Tracking Station
WSC	White Sands Complex
WWW	World Wide Web